RFO F 1325.8

United States Government

Department of Energy

Rocky Flats Field Office

memorandum

DATE: JUN 15 2001

REPLY TO ATTN OF: FPA:NRD:EJW:01-01163

SUBJECT: Approval of Site Safety Analysis Report Chapter 6 Page Change

TO: Alan M. Parker
President & CEO
Kaiser-Hill Company, L.L.C.

Reference: Letter, Almon to Hartmann, 01-RF-00880, dtd 4/25/01, subject: Transmittal of Site Safety Analysis Report Chapter 6 Page Change

The purpose of this memorandum is to provide the Department of Energy Rocky Flats Field Office (RFFO) approval of page change PGC-RFP-01.0120-BMM, Revision 1. This page change constitutes a complete rewrite to the Site Safety Analysis Report (Site SAR), Chapter 6, Safety Management Programs, and will result in a revision to the Site SAR (revision 3). The RFFO has reviewed the page change and approves it with the technical direction stated in the attachment. The attachment documents the results of RFFO's review and basis for approval of the page change. Review and approval of the submitted page change is in accordance with contract DE-AC34-00RF01904, Section J, Attachment B.

Should you have any questions, please contact me at extension 2025 or my point of contact on this matter, Ed Westbrook, at extension 7074.

Barbara A. Mazurowski
Manager

Attachment

cc w/Att:
S. Stadler, EH-2, HQ
J. Fiore, EM-30, HQ
M. Jones, EM-33, HQ
D. Owen, DNFSB
P. Hartmann, AMFPA, RFFO
D. Noyes, DAMPFA, RFFO
R. Bostic, NRD, RFFO
E. Westbrook, NRD, RFFO
J. Hansen, K-H
P. McEahern, SMI

Basis for Approval
Page Change PGC-RFP-01.0120-BMM to the
Site Safety Analysis Report, Chapter 6,
Safety Management Programs

References:

1. Site Safety Analysis Report (Site SAR), Chapter 6, Revision 2, November, 2000

Scope of the Changes:

The proposed page change constitutes a complete rewrite of the Site SAR, Chapter 6, Safety Management Programs (SMPs) and will result in a new revision to the Site SAR (revision 3). This page change incorporates a new format for describing the individual SMPs, their nuclear safety attributes and their importance to the authorization basis. In addition, several sections currently in Chapter 6 have been deleted and several new sections have been added. Specifically, sections pertaining to Organization and Management, Integrated Safety Management, Corrective Action, Occurrence Reporting, Procedures, and Independent Safety Review and Assessments have been removed. The new sections in chapter 6 are Criticality Safety, Integrated Work Control, and Document Management.

This page change also includes a written commitment to SMPs in the Introduction of the revised Chapter 6. This commitment ties SMP monitoring and reporting to PRO-1331-SMP, *Management and Assessment of the Safety Management Programs*. This revised Chapter 6 directs SMP owners to use the cited procedure to identify the performance criteria for evaluating their programs, and establishes a mechanism for routinely reporting performance monitoring results. This procedure was not submitted with the page change.

The proposed page change also defines the relationship between facility-specific authorization basis documents and the Site SAR with respect to SMPs.

Approval Bases:

Chapter 6 of the Site SAR addresses the Rocky Flats Environmental Technology Site (RFETS) Safety Management Programs (SMPs). The SMPs implement numerous DOE Orders and a variety of other requirements and regulations, and comprise the safety infrastructure at the RFETS. Chapter 6 briefly describes those site programs designated as SMPs, states their importance to the authorization basis, identifies Programmatic Key Elements, and provides references to regulatory drivers and applicable RFETS programmatic documentation and nuclear safety calculations cited in the SMP text.

The program descriptions are intended to provide a brief summary of the individual SMPs and how they contribute to the overall safety at the Site. They are not intended to reiterate the more thorough descriptions provided in the applicable Site Manuals that are referenced at the end of each section. The Programmatic Key Elements are self-explanatory: they are specific SMP components possessing significant importance. Each SMP has three common key elements: (1) Organization and Administration, (2) Training and Qualification, and (3) Configuration Management.

Individual SMPs have been developed for each of the following disciplines:

- Conduct of Operations
- Configuration Management
- Criticality Safety
- Document Management
- Emergency Preparedness
- Engineering
- Environmental Management
- Fire Protection
- Integrated Work Control
- Nuclear Safety
- Occupational Safety and Industrial Hygiene
- Quality Assurance
- Radiological Protection
- Testing, Surveillance, and Maintenance
- Training
- Transportation Safety
- Waste Management

As stated above, the specific site programs designated as SMPs differ between the current Chapter 6 (i.e. revision 2) and this page change. Six SMPs from revision 2 have been deleted and three new SMPs have been added. During the review of this page change it was determined that the relevant processes from the deleted SMPs have not simply been removed from this chapter, but have been realigned into other sections. For example, Integrated Safety Management (ISM) is still recognized as an important process at the RFETS, but instead of being isolated into a stand alone SMP it is now described and committed to in the Introduction of Chapter 6. Essentially, ISM is recognized as having more global importance to work performed at the Site. The other deleted SMPs have been treated somewhat similarly. The Occurrence Reporting SMP was removed, but the process and its importance are discussed in the Introduction of Chapter 6. Other deleted SMPs have had their functions realigned into other SMPs included in this page change. Consequently, the SMPs presented by this page change address an appropriate set of site programs and processes.

It should be noted that the SMPs are recognized to be integral to the safe performance of work activities at the RFETS although not explicitly cited in nuclear safety accident analyses. These analyses recognize the fact that personnel performing work are trained, that procedures are developed and controlled through rigorous processes, and that procedural compliance is a priority at the Site. However, these elements are not explicitly credited with reducing the frequency of any postulated/analyzed accidents. Consequently, this review does not address accident analysis.

The Site SAR SMPs have increased in significance with this revision since it alters the interrelationship between the Site SAR and facility-specific authorization basis documents. Facility-specific authorization basis documents will only discuss differences or exceptions from the key elements presented in the Site SAR SMPs. Consequently, if a facility implements their

SMPs solely through Site programs, a direct reference can be made to Chapter 6 of the Site SAR without further discussion. Due to this increased importance the Rocky Flats Field Office (RFFO) review of this submittal was performed by a team of Subject Matter Experts (SMEs).

The RFFO SMEs were provided copies of the SMP section(s) that pertained to their work assignments/areas of expertise for review. Comments generated during this review phase were consolidated and forwarded to the contractor prior to a cross-table discussion of the RFFO issues and concerns.

A recurring comment from the RFFO SMEs was the lack of performance indicators or the potential inadequacy of the indicators identified. This issue was discussed in detail during the cross-table. It was agreed that SMP owners require the flexibility to change or modify their performance indicators based upon the indicators' ability to provide useful data. Specifically identifying the individual performance indicators in the Site SAR would require a DOE approved page change each time an indicator was determined to be in need of modification. The RFFO agrees that this is not prudent and accepted a proposal to have the performance indicators controlled by a site level procedure. The procedure (PRO-1331-SMP, *Management and Assessment of the Safety Management Programs*) is clearly identified in the Introduction of the revised Chapter 6. It is also recognized by the RFFO that this procedure must be implemented concurrently with this page change.

The RFFO also had concerns regarding the contractor's level of commitment to the SMPs. The Chapter 6 Introduction now includes affirmation of the Kaiser-Hill commitment to the SMPs. The stated commitment assures that the contractor will monitor program performance, self-identify deficiencies, provide prompt and complete reporting, perform root causes analyses on process and program deficiencies, and develop comprehensive corrective actions. The Administrative Controls (ACs) within the facility-specific authorization basis documents are also cited as evidence of the contractor's commitment. These authorization basis documents contain ACs invoking SMP compliance. The Site SAR commits all other facilities to the SMPs via an AC in Chapter 7.

During the review it was noted that section 6.12.3, "Exemption", states that "a permanent exemption EX-057A, *Exemption to Code Compliance Requirement for Existing Vessels and Piping Systems at Rocky Flats Environmental Technology Site*, was submitted to DOE, RFFO on May 9, 2000 and was subsequently approved." This statement is erroneous: the exemption request was not approved. The exemption request was determined to be not required. The requirements in question were determined to be not applicable to the RFETS due to the Site's limited operating life, closure mission, and ongoing maintenance program for pressure vessels. (see technical direction 1)

Additional comments generated by the RFFO were either worked to conclusion at the cross-table or tabled for more detailed off-line discussions. The subsequent discussions were successful in resolving those comments. The Kaiser-Hill submittal addressed in this document contains the changes agreed to with the RFFO SMEs. As a result, the submitted page change is acceptable.

Conclusion:
Page Change PGC-RFP-01.0120-BMM is approved with the following technical direction.

Technical Direction:

1. Replace the section 6.12.3 paragraph titled "Exemption" with the following:

   "A permanent exemption EX-057A, *Exemption to Code Compliance Requirement for Existing Vessels and Piping Systems at Rocky Flats Environmental Technology Site*, was submitted to DOE, RFFO on May 9, 2000. This exemption request addressed the DOE Order 440.1A requirement that all pressure vessels and supporting piping systems comply with American Society of Mechanical Engineers (ASME) B31 Piping Code and/or the strictest State and local codes. The exemption was determined to be unnecessary by the DOE. DOE Headquarter (EM-33) correspondence dated October 24, 2000 stated that it was "obvious that the ASME code was not applicable to Rocky Flats Environmental Technology Site (RFETS) considering that RFETS is near the end of its operating life, is scheduled for closure, and is to continue the maintenance program for pressure vessels until the RFETS closure mission is complete." "

Verbatim replacement does not require additional DOE approval.

2. Replace the first two sentences of the first paragraph of section 6.4.2 under "Exemptions", with the following:

   "Exemption RFPK-DOE-C-420.1-EX-033F was approved by the DOE, RFFO on May 24, 2001."

Verbatim replacement does not require additional DOE approval.

RFO F 1325.8

United States Government — Department of Energy

Rocky Flats Field Office

memorandum

DATE: JUL 03 2001

REPLY TO ATTN OF: FPA:NRD:EJW:01-01292

SUBJECT: Approval of Site Safety Analysis Page Change PGC-RFP-01.1523-ARS

TO: Alan M. Parker
President & CEO
Kaiser-Hill Company, L.L.C.

Reference: Letter, Brailsford to Golan, 01-RF-01520, dtd 6/28/01, subject: Site Safety Analysis Report (SAR) Page Change Request for Site Transportation Control (STC) (PGC-RFP-01.1523-ARS)

The purpose of this memorandum is to provide the Department of Energy (DOE) Rocky Flats Field Office (RFFO) approval of page change PGC-RFP-01.1523-ARS. This page change proposes modifying Site Transportation Control (STC) 5 to allow Powered Industrial Trucks (PITs), also known as forklifts, to unload two containers (i.e., Standard Wastes Boxes, IP-2s, etc.) at a time. Changes to STC 5 will also allow the use of cranes to unload individual containers. The page change also removes exceptions from STCs 2 and 3 that are not supported by existing analysis. The RFFO has reviewed the page change and approves it with the technical direction provided in the attachment. The attachment documents the results of RFFO's review and basis for approval. Review and approval of the submitted page change is in accordance with contract DE-AC34-00RF01904, Section J, Attachment B.

Should you have any questions, please contact me at extension 2025 or my point of contact on this matter, Ed Westbrook, at extension 7074.

Barbara A. Mazurowski
Manager

Attachment

cc w/Att:
S. Stadler, EH-2, HQ
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D. Owen, DNFSB
P. Hartmann, AMFPA, RFFO
R. Bostic, NRD, RFFO
E. Westbrook, NRD, RFFO
D. Noyes, FA, RFFO
M. Brailsford, K-H
J. Hansen, K-H

Basis for Approval of the Site Safety Analysis Report Page Change Request PGC-RFP-01.1523-ARS for Site Transportation Control

Reference:
(1) Letter, Brailsford to Golan, 01-RF-01520, dtd 6/28/01, Site Safety Analysis Report (SAR) Page Change Request for Site Transportation Control (STC) (PGC-RFP-01.1523-ARS) – MDB-156-01, Kaiser-Hill Company, Rocky Flats Environmental Technology Site, Golden, CO
(2) Memo, Mazurowski to Card, AME:NRD:MP:00-02784, dtd 6/12/00, Authorization Basis Development, U.S. Department of Energy, Rocky Flats Field Office, Golden, CO
(3) Marr, Jeffrey W. *Applicable Airborne Release Fractions (ARFs) and Respirable Fractions (RFs) for Surface-Contaminated, Combustible Waste in 55-Gallon Metal Drums During Fires*, Nuclear Safety Technical Report NSTR-008-01, Kaiser-Hill Company, Rocky Flats Environmental Technology Site, Golden, CO, Revision 1, May 2000

Background:

Kaiser-Hill Company (K-H) has submitted a page change to the Site Safety Analysis Report (SSAR) to revise the Site Transportation Controls STC 2, STC 3, and STC 5 (Reference 1). STC 5 provides specific controls for Transuranic (TRU) waste and Low Level Waste (LLW) transfers between facilities using Powered Industrial Trucks (PIT), also known as forklifts. The STC 5 changes were necessary due to a violation to the STC 5 programmatic transportation controls that prohibit PITs from transferring more than one TRU Standard Waste Box (SWB) at a time. PITs with long tines to handle two SWBs, LLW boxes, or IP-2 containers at a time were being used when the STC 5 controls were originally approved, but the STC 5 controls to prohibit more than one container was not incorporated into Site transportation work control documents at that time. Following identification of this discovery issue, loading/unloading activities were curtailed until the STC 5 controls were implemented in the work control documents. The existing transportation safety analysis evaluates PIT operations for radioactive material transfers between facilities, but does not specifically analyze loading and unloading of flatbed trucks by PIT or crane. Dock activities are normally addressed in individual facility authorization basis (AB) documents. Reference 1 also concluded that using PITs with long tines to load/unload trucks is a Discovery Issue Unreviewed Safety Question (USQ) due to increases in probabilities and consequences of previously analyzed accidents.

STC 2 provides specific controls for onsite transfer of nuclear materials, residues and radioactive wastes greater than 200grams weapons grade plutonium, but less than or equal to 6 kilograms, per load. STC 3 provides specific controls for the same material transfers up to 200 grams per load. Both controls have an exception statement that permits use of propane PIT for loading and unloading, but this exception lacks a technical basis from the transportation safety analysis.

This page change evaluates the risk associated with performing these activities and identifies controls to mitigate and/or prevent accidents.

Discussion:

The page change submittal affects the SSAR Chapter 7 Site Controls and Chapter 8 Transportation Safety Analysis. Only page changes affecting the Chapter 7 STC 2, STC 3, and STC 5 are proposed in the submittal. The submittal commits to revising Chapter 8 during the next annual update, along with other changes due to revised accident analysis methodologies and the 6/12/00 Nuclear Licensing Streamline Initiative (Reference 2).

The proposed changes to STC 5 maintain the existing requirements for inter-building transfer operations, with the exception of prohibiting inter-building transfers of TRU waste drums using PITs. It also introduces a new control section specifically for material transfer vehicle loading and unloading using PITs or crane, when not specifically controlled by other facility AB requirements. This new control permits PITs to load/unload up to two boxes (SWBs, LLW, or IP-2) at a time, and permits cranes to load/unload a single box, pallet, drum or cargo container at a time.

The current SSAR transportation safety analysis evaluated five spill and five fire accidents associated with PIT transfers between buildings. The scenarios addressed LLW in drums and wooden boxes, TRU wastes in drums and SWBs, and high-americium TRU wastes not in Pipe Overpack Containers.

To derive the revised STC 5 controls, the analysis was revised to evaluate 14 spills and 15 fires involving LLW in drums and wooden boxes, Surface Contaminated Object (SCO) packages, TRU wastes in drums and SWBs, overloaded SWBs, and Box-N-Go SWBs of TRU wastes. Based on the SSAR Revision 2 methodology and assumptions, the frequencies, consequences, and risks for these new accidents as impacted by the STC 5 proposed changes are summarized in the page change submittal Figure 2 (Reference 1), and are not repeated here. The revised analysis concludes that four of the spills and two of the fire scenarios resulted in *Moderate* or *High* (6.4 rem) consequences to the public, and are Risk Class I or II due to *Anticipated* spills and *Unlikely* fires. For the collocated worker, eight of the spills and four of the fire scenarios resulted in *Moderate* or *High* (220 rem) consequences, and are Risk Class I or II due to *Anticipated* spills and *Anticipated* or *Unlikely* fires. Therefore, 12 of the 29 new scenarios are Risk Class I or II for either the public or collocated worker. The consequences for dropping a single Box-N-Go SWB, and 2 SWBs of all kinds (normal, overloaded, and Box-N-Go) are *Moderate*, Risk Class I to the MOI. The consequences of *Anticipated* TRU waste spills and punctures (drums, boxes, SWBs) are *Moderate*, Risk Class I to the collocated worker. The consequences to the MOI of a pool fire involving a single TRU waste drum are *Moderate*, Risk Class II, but are *High* consequence/Risk Class I if four drums are involved. The consequences of LLW drum pool fires and fires with two Box-N-Go SWBs are *Moderate*, Risk Class II and I, respectively, to the collocated worker. The consequences of TRU waste drum pool fires are *High*, Risk Class I to the collocated worker.

Compared to the previous analysis for STC 5, the proposed changes constitute increases in the frequency and consequences of fires, and increases in the consequences of spills. Therefore, this is a positive USQ. Although it is a Discovery Issue, K-H corrected the condition temporarily by revising transportation work controls to implement the STC 5 restrictions, until this page change can be approved and implemented. The positive USQ is documented in USQD-RFP-01.1623-ARS.

The increase in frequency of fires is primarily due to a change in methodology that is based on guidance being applied for recently-approved facility ABs. The original forklift fire frequency was based on the onsite transportation estimate for transport vehicle fires. The revised estimates were based on qualitative arguments that concluded that forklift fires other than pool fires are assumed to remain in the *Anticipated* frequency bin. Pool fires are assumed *Unlikely* because of the medium size of fire and physical conditions necessary to cause lid loss.

The K-H conclusions of the safety analysis from Reference 1 are:

> ". . . Therefore, it is concluded that no practical or cost effective controls are available to reduce the risk of TRU waste drum pool fires to Risk Class III for either the MOI or the CW. The significant consequences to the MOI and CW from pool fires involving TRU wastes drums are deemed unacceptable. Therefore, the proposed page change prohibits inter-building transfer of TRU waste drums with fossil fueled PITs, and also prohibits material transfer vehicle loading and unloading of TRU waste drums with fossil fueled PITs or cranes. . ."

The proposed changes to STC 2 and STC 3 remove an exception statement that permitted use of a propane PIT for loading and unloading. This exception statement lacked a technical basis and was not supported by the SSAR transportation safety analysis.

Basis for Approval:

With one exception, the accident analysis assumptions are consistent with the SSAR Chapter 8 Transportation Safety Analysis, or recently approved accident analyses of similar material-at-risk (MAR) in facility AB documents (e.g., overloaded SWBs and Box-N-Go packages). The exception is how drums engulfed in a flammable/combustible liquid pool fire were modeled. The SSAR page change assumes that all four drums in the pool burn as an unconfined combustible material release with a 5E-2 airborne release fraction (ARF), which implies that all contents would be ejected (otherwise the Site practice from the *Safety Analysis and Risk Assessment Handbook* [SARAH] is to assume a 5E-4 ARF for burning inside a drum that experiences lid loss only).

This is not consistent with the recent resolution of the SARAH Upgrade Task T19 on drum fire modeling that has been applied for the Building 771 Decommissioning Basis for Interim Operation and the Building 440 Final Safety Analysis Report. A revised methodology for evaluating drums engulfed in a pool fire has been documented in NSTR-008-01, *Applicable Airborne Release Fractions (ARFs) and Respirable Fractions (RFs) For Surface-Contaminated, Combustible Waste in 55-Gallon Metal Drums During Fires* (Reference 3). Except for the use of average MAR, RFFO has concurred with the NSTR-008-01 assumptions regarding 25% of all drums involved in the pool resulting in lid loss with 1/3 ejection of contents that could burn as an unconfined combustible material fire with a 1E-2 ARFxRF, and the remainder of the MAR evaluated as a confined material release with 5E-4 ARFxRF (but with varying damage ratios depending on the number of drums involved).

If the NSTR-008-01 methodology were applied, the previously summarized consequences and risks are expected to be significantly reduced. Technical direction is being given to apply the NSTR-008-01 methodology for the next annual update along with the other SSAR Chapter 8 Transportation Safety Analysis as committed in the page change submittal (Reference 1).

For perspective, the page change submittal also provided the impact of applying the new methodologies (e.g., ICRP 68 dose conversion factors, revised *Low/Moderate* consequence thresholds) approved for the Nuclear Licensing Streamline Initiative (Reference 2). The 29 spill and fire scenarios are summarized in Figure 3 of the page change submittal (Reference 1). Of the previously mentioned 12 spill and fire scenarios that result in Risk Class I or II for the public or collocated workers, only two *Unlikely* scenarios involving pool fires with 1 or 4 TRU drums would remain Risk Class I or II due to *High* (97 rem to CW) or *Moderate* (1.8 rem to MOI) consequences. Limiting material transfer vehicle loading and unloading activities to one TRU waste drum at a time would reduce the consequences of a pool fire *Low*, Risk Class III to the MOI, but the risk to the CW would be *Moderate*, Risk Class II. The consequences and risks of these two scenarios are also expected to be significantly reduced when the NSTR-008-01 methodology is applied.

Conclusion:

RFFO acknowledges the positive USQD-RFP-01.1623-ARS associated with the Discovery Issue of using forklifts with long tines to handle two boxes at a time. RFFO concurs with the revised accident analysis for the page change submittal and accepts the risks for the associated scenarios. Therefore, RFFO approves the page change PGC-RFP-01.1523-ARS.

DOE Technical Direction:

1. Revise the pool fire scenarios to apply the drum methodology described in NSTR-008-01 with bounding (not average) MAR assumptions, and include the analysis with the other SSAR Chapter 8 Transportation Safety Analysis revisions as identified in PGC-RFP-01.1523-ARS during the next annual update to the SSAR.

RECEIVED

Revised 02/02

CORRES. CONTROL INCOMING LTR NO.

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Memorandum

CORRESPONDENCE CONTROL

Rocky Flats Field Offi

DUE DATE 5/10/02

ACTION ITO/ BRAILSFORD

APR 9 2002

SP:NRD:DEF:02-00532

Approval of Site Safety Analysis Page Change PGC-RFP-02.0635-DCI

Alan M. Parker
President & CEO
Kaiser-Hill Company, L.L.C.

Reference: Letter, Brailsford to Mazurowski, dtd 1/15/02, subject: Rocky Flats Environmental Technology Site (Site) Safety Analysis Report (SAR) Page Change for Powered Industrial Truck (PIT) Transfer of Waste Boxes – MDB-005-01

The purpose of this memorandum is to provide the Department of Energy Rocky Flats Field Office (RFFO) approval of page change PGC-RFP-02.0635-DCI. This page change proposes modifying Site Transportation Control 5 to allow Powered Industrial Trucks (PITs), also known as forklifts, to transfer two boxes at a time around the site. The RFFO has reviewed the page change and it is approved subject to completion of the attached Technical Direction. The attachment documents the basis for approval and contains the Technical Direction.

Should you have any questions, please contact me at extension 2025 or my point of contact on this matter, David Faulkner, at extension 2011.

Barbara A. Mazurowski
Manager

DIST.	LTR	ENC
BOGNAR, E.	X	X
BRAILSFORD, M.D	X	X
CIUCCI, J. A.	X	X
COLALANCIA, M.	X	X
DEGENHART, K.	X	X
FERRERA, D.		
FERRI, M. S.		
GEIS, J. A.	X	X
GERMAIN, A. L.		
GIACOMINI, J.	X	X
HALL, L.		
HANSON, J. L.	X	X
MARTINEZ, L. A.	X	X
MCEAHERN, P.	X	X
MCLAUGHLIN, J.	X	X
MILLER, G. M.	X	X
MILLER, J. C.	X	X
PARKER, A.M.	X	X
POWERS, K.	X	X
SCOTT, G.K.		
SHELTON, D.C.		
SNYDER, D.	X	X
SPEARS, M. S.		
STITHEM, A.	X	X
TRICE, K.D.		
TUOR, N. R.		
VOORHEIS, G. M.		
GLEASON, B.	X	X
ITO, F.	X	X
DEICHLER, C	X	X
Walker-Lemble	X	X
Plappert, R.	X	X

COR. CONTROL	X	X
ADMIN. RECORD		
PATS/130	X	X

Reviewed for Addressee Corres. Control RFP

4/10/02 Date bg By

Ref. Ltr. # 02RFO0183

DOE ORDER # 5480.23

Attachment
cc:
M. Frei, EM-30, HQ
F. Shepperd, EM-33, HQ
D. Owen, DNFSB, RFFO
J. Schnieder, AMP, RFFO
D. Sargent, AMSP, RFFO
R. Bostic, NR, RFFO
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P. McEahern, SMI

Basis for Approval
Page Change PGC-RFP-02.0635-DCI, Site Safety
Transportation Control STC5, Change Limit To A Maximum Of Two Waste Boxes Per Transfer By Forklift

References:

1) Letter, Brailsford to Mazurowski, 02-RF-00183, dtd 1/15/02, Transmittal of Rocky Flats Environmental Technology Site (Site) Safety Analysis Report (SAR) Page Change for Powered Industrial Truck (PIT) Transfer of Waste Boxes – MDB-005-01, Kaiser-Hill Company Rocky Flats Environmental Technology Site, Golden, CO.
2) PGC-RFP-02.0635 DCI, Site Safety Analysis Report (SAR) Page Change, Site Transportation Control STC 5, Change Limit to a Maximum of Two Waste Boxes Per Transfer by Forklift, dtd 01/10/02, Kaiser-Hill Company Rocky Flats Environmental Technology Site, Golden, CO.
3) Letter, Mazurowski to Parker, FPA:NRD:EJW:01-01292, Approval of Site Safety Analysis Page Change GC-RFP-01.1523-ARS, dtd 7/03/01, U. S. Department of Energy, Rocky Flats Field Office, Golden, CO.
4) Rocky Flats Environmental Technology Site Safety Analysis Report, Volume 1, Revision 2, September 19, 2001, Kaiser-Hill Company Rocky Flats Environmental Technology Site, Golden, CO.
5) Memo, Mazurowski to Card, AME:NRD:MP:00-02784, dtd 6/12/00, Authorization Basis Development, U.S. Department of Energy, Rocky Flats Field Office, Golden, CO
6) DOE G460.1-1, Implementation Guide for Use with DOE O460.1A, Packaging and Transportation Safety, 06-05-97, U. S. Department of Energy, Washington, D.C.
7) DOE G 423.1-1, Implementation Guide for Use in Developing Technical Safety Requirements, 10-24-01, U. S. Department of Energy, Washington, D.C.
8) SAND79-1305, Summary of Research and Development Activities in Support of Waste Acceptance Criteria for WIPP, Sandia Laboratories, June 1979.
9) NSTR-008-01, Applicable ARFs and RFs for Surface Contaminated, Combustible Waste for 55-gallon Drums During Fires, Kaiser Hill Rocky Flats Environmental Technology Site, Golden, CO.

Scope of the BIO/TSR Change:

The change submitted by the Kaiser-Hill Company in Reference 1 proposes revision to Section 7.5.4.6, Site Transportation Control (STC) 5. This change affects programmatic controls for performance of on-Site transfers of radioactive materials using a powered industrial truck (PIT), also called a forklift truck. STC 5 specifically addresses loading/unloading operations and transfer between facilities of Transuranic (TRU) waste and Low Level Waste (LLW) using PITs. This change is intended to allow movement of

'two' boxes at one time using a PIT to support the on-Site transfer mission. These are either TRU boxes with a maximum of ≤325 g WG Pu or LLW. The submittal in PGC-RFP-02.0635-DCI evaluates the risk associated with performing these activities and identifies controls to mitigate and/or prevent accidents.

Approval Bases:
PGC-RFP-02.0635-DCI provides the description and technical justification of the proposed change (Reference 2) to STC 5. Previous Technical Direction concerning PIT accidents in Reference 3 required that the pool fire scenarios be revised to apply the drum methodology described in NSTR-008-01, which is included in PGC-RFP-02.0635-DCI. This change affects the Site Safety Analysis Report (SSAR) Chapter 7, Site Controls and Chapter 8, Transportation Safety Analysis (Reference 4). The submittal commits to revising Chapter 8 during the next annual update.

The Approved Methodology case in Reference 2 is essentially the same results that were presented for loading and unloading of two boxes. The analysis includes 14 spills and 15 fires involving Low Level Waste (LLW) in drums and boxes, Surface Contaminated Object (SCO) packages, transuranic (TRU) wastes in drums and Standard Waste Boxes (SWBs), overloaded SWBs, and Box-N-Go SWBs of TRU wastes.

The revised analysis found that 12 of the 29 scenarios were a Class I or II for either the public or collocated workers. Table 1 below gives a comparison to the current authorization basis. A spill involving 2 SWBs is 0.1 rem to the MOI and 10 rem to the CW and is a Risk Class I event. The Risk Class designation for this spill is due to assuming that it is *Anticipated*. A nonlofted fire involving 2 SWBs is 0.46 rem to the MOI and 47 rem to the CW and a lofted fire is 0.01 rem to the MOI and 0.37 rem to the CW. The nonlofted fire is a Risk Class I and lofted is a Risk Class III. Events involving LLW are a Risk Class III, with exception of a pool fire involving 4 LLW drums, which is 0.56 rem to the CW and a Risk Class II.

Table 1 also provides the consequences obtained using the new analytical methodology proposed for the Authorization Basis Streamlining initiative (Reference 5). A significant reduction in consequences is realized using ICRP 68 dose conversion factors with all scenarios having a *Low* consequence. It is forthcoming that classification for these sequences would not exceed a Risk Class III. This result is used for risk perspective and is not used for justification of the control set.

Table 1 Comparison of Page Change Scenario Results with SSAR Scenario #10

Scenario	Approved Method		AB Streamlining Method	
	MOI (rem)	CW rem	MOI (rem)	CW (rem)
SSAR #10 Spill SWBs 320 g WG Pu -Bounding Case in Ch 8 Unlikely	*Low 0.050 Risk Class III*	*Moderate 4.9 Risk Class II*	*N/A*	*N/A*
1 SWB Spill 325 g WG Pu *Anticipated*	Low 0.052 Risk Class III	Moderate 5.1 Risk Class I	Low 0.023 Risk Class III	Low 1.1 Risk Class III
2 SWBs Spill 650 g WG Pu *Anticipated*	Moderate 0.10 Risk Class I	Moderate 10 Risk Class I	Low 0.047 Risk Class III	Low 2.3 Risk Class III
1 Overloaded SWB Spill 410 g WG Pu *Anticipated*	Low 0.065 Risk Class III	Moderate 6.4 Risk Class I	Low 0.029 Risk Class III	Low 1.0 Risk Class III
2 Overloaded SWB Spill 820 g WG Pu *Anticipated*	Moderate 0.13 Risk Class I	Moderate 13 Risk Class I	Low 0.059 Risk Class III	Low 2.8 Risk Class III
SSAR SWB Fire 320 g WG Pu Extremely Unlikely (nonlofted)-Bounding Case in Ch 8	*Moderate 0.25 Risk Class III*	*Moderate 25 Risk Class III*	*N/A*	*N/A*
1 SWB Fire 325 g WG Pu (lofted) *Anticipated*	Low 0.0052 Risk Class III	Low 0.18 Risk Class III	Low 0.0015 Risk Class III	Low 0.079 Risk Class III
2 SWB Fire 650 g WG Pu (lofted) *Anticipated*	Low 0.01 Risk Class III	Low 0.37 Risk Class III	Low 0.010 Risk Class III	Low 0.55 Risk Class III
2 SWB Fire 650 g WG Pu (nonlofted) *Anticipated*	Moderate 0.46* Risk Class I	High 47* Risk Class I	Not Analyzed	Not Analyzed
2 Overloaded SWBs Fire 810 g WG Pu (lofted) *Anticipated*	Low 0.013 Rick Class III	Low 0.46 Risk Class III	Low 0.0038 Risk Class III	Low 0.20 Risk Class III
2 Overloaded SWBs Fire 810 g WG Pu (nonlofted *Anticipated*	Moderate 0.57* Risk Class I	High 59 Risk Class I	N/A	N/A

*Result is shown for a nonlofted fire equivalent to that presented in the approved Chapter 8 analysis using Radidose 1.1 and assuming a nonlofted plume.

Basis for acceptance of these accidents is referred to the Safe Harbor rules explained in DOE G421.1-2. Before non-equivalent packaging may be used a performance envelope is established and the associated transport system ensures that it can operate safety. The acceptance is based on the proposed changes to the controls in Table 7-8.b of the SSAR. The technical requirements that are developed to ensure that the transportation system for two SWBs prevents fires and spills for non-equivalent packaging between facilities are in accordance with paragraph 4.14 in DOE G423.1-1 (Reference 7). The performance

envelope credits that the SWB is qualified as a DOT Type A container for transfer of LLW. The principal elements of control for the transport system are:

- Inventory control
- Allowable routes
- PIT speeds
- PIT fuel restrictions
- PIT configuration and capacity
- Loading and unloading controls
- Operator qualifications
- Packaging controls
- Emergency Response communication

The bases for acceptance include a number of factors. The first element is the Applicability of the control for transfer by PITs between facilities. Restricting transfers to TRU SWBs with ≤325 g WG Pu or LLW drums is an inventory limit. Further restricting the number of items to two SWBs or four LLW drums further limits the inventory. The transfer limit becomes ≤650 g WG Pu for the two SWBs and 2 g WG Pu for the four LLW drums. The analysis provides the dose results if a deviation to this control occurs by assuming the SWBs could be overloaded to ≤820 g WG Pu for two SWBs. The control only allows one overloaded SWB with ≤410 g WG Pu if it is known to be overloaded. Since estimation methods are used for equipment and waste packed in SWBs overloaded SWBs have to be considered. Two SWBs overloaded above 820 g WG Pu is considered outside of the analyzed envelope. Drums are limited to LLW, which is approximately 100 nCi/g or <1 g WG Pu/drum and meet DOT Type A criteria. Inventory control mitigates the consequences that can result from the higher loaded SWBs. The inventory control value is a plutonium equivalent intended to assure that operations involving americium from ingrowth are accounted for.

Acceptance of fire involving two SWBs containing TRU requires some explanation. The SWB is listed as a DOT Type A package and is used to transfer Type B quantities of material. First the fire mechanism is conservative and secondly the analysis did not credit the new controls. Pool fire studies performed at SANDIA show that the contents of SWBs encased in metal pyrolyze (Reference 8). A review of NSTR-008-01 finds that a fire involving SWBs takes into consideration that the package is not leak tight and there could be seal failure even though the lids are bolted (Reference 9). An SWB lid would not undergo catastrophic rupture as do the TRU 55-gallon drums. The material release is dependent on the quantity of material within the SWB that pyrolizes. Given that air for combustion is limited within the SWB, and fresh air would not easily enter due to the slight overpressure within the SWB (caused by the exposure fire), limited quantities of material would burn. In addition, much of the contents is typically noncombustible, further reducing the fuel available for pyrolysis. Considering this, it would take a considerable combustible loading and time to develop an exposure fire large enough to cause significant pyrolisis within the SWB. From this conclusion the following engineering judgements are made.

- The effect of a fire from either a PIT or any other combustible load source along the roadway would be localized. The BTU loading necessary to

pyrolize a significant quantity of the contents of the SWBs would be required to be large. Qualitatively, the damage to the contents would probably be less than the 20% DR used for SWBs, which was based on paper in file cabinets, essentially 100% combustible material.

- Data for actual forklift fires is lacking, but is probably closer to *unlikely*. The *anticipated* frequency is a site convention.

In conclusion, the actual consequences of a nonlofted fire involving two overloaded SWBs with ≤820 g WG Pu would then present consequences closer to the Evaluation Guideline for the CW of 25 rem and may be much less if the package contents combustibility is taken into consideration.

In addition crediting controls and the SMPs can decrease the frequency. The frequency of such a fire is reduced from *anticipated* to *unlikely*. With additional supporting data for PIT fires the frequency may be as low as *extremely unlikely*. The following controls affect frequency:

- Limiting the route between Buildings 440 to 664.
- Verification of no combustibles within 10 feet from the PIT along the transfer route.
- The fire department would respond within approximately 15 minutes. Limiting fire growth and duration.
- The PITs are maintained and operators are trained in accordance with site programs.

Therefore, based on engineering judgement the actual risk to the public is closer to a Risk Class II to III and not a Risk Class I. Because fire growth is a consideration SWBs with ≤325 g WG Pu each (650 g WG Pu total) are allowed and four TRU drum with 200 g WG Pu equivalent each (800 g WG Pu total) are not allowed.

Specific programmatic elements act to ensure prevention and mitigation of fires and spills as summarized below.

1. Limiting the number of packages in a transfer is an element. The control is four LLW drums or two SWBs/boxes with TRU or LLW. Overloaded SWBs is limited to one per transfer. This also limits the consequences to within those accepted for this activity.
2. The elements require that drums and SWBs be secured. SWBs/boxes or LLW drums must be palletized. These prevent spills from occurring. The use of the pin-lifters or lifting lugs on the SWBs are not acceptable for transfer operations.
3. By limiting the transfers to drums with LLW the consequences are significantly reduced.
4. Prohibiting transfer of TRU waste drums prevents the unacceptable consequences of pool fires.
5. Combustible load controls for TRU SWB transfers prevent fires.
6. A control that requires packaging approved by the Site Transportation Safety Manual (STSM) ensures that as a minimum DOT Type A packages are used for all transfers. If not, the transportation program requires an analysis.

7. Eliminating the use of propane-powered trucks prevents and mitigates the potential by rendering the scenario as *beyond extremely unlikely*. Cranes of any type are prohibited from transferring radioactive materials since there were not specifically analyzed.
8. Transfers of 2 SWBs, or 2 LLW boxes, or 4 LLW drums to between Building 440 and Building 664 is acceptable as they are adjacent facilities.
9. LLW routes are limited to within established areas of the site. Route restrictions simply minimize the activity duration and any unanalyzed road or environmental conditions. The established areas are:
   - The 300 area
   - The 400 area
   - The 700 area (includes Buildings 559 and 569 as part of this area)
   - The 800 area

The Safety Management Programs (SMPs) in Chapter 6 are relied upon to meet a number of assumptions in the analysis. The implementing procedure for this activity shall include the appropriate requirements of the following:

- Requirements of the Occupation Safety and Industrial Hygiene Program Manual for PITs operations to assure that personnel who perform transfers are trained and qualified.
- Assure PITs are configured for and have necessary capacity to transfer two SWBs/LLW boxes.
- Work Control Documents are developed in accordance with the site Integrated Safety Management system to ensure individual transfers are properly controlled.
- Nuclear material inventory limits are verified prior to transfer
- Packaged in accordance with STSM and Waste Management Programs.

The Site Integrated Safety Management program in conjunction with the SMPs will be relied on to implement any special communication requirements necessary for inclusion in Work Control Documents (see Technical Direction #1).

Conclusion:
The change proposed in PGC-RFP-02.0635-DCI is approved.

DOE Technical Direction:

1. Determine, if any, special communication requirements are necessary for inclusion in Work Control Documents (as required by DOE Guide 460.1A). Inform RFFO of the results and basis for the determination. Complete this action PRIOR to implementation of this page change.
2. Additional technical direction is to word the page change as shown in Attachment B. Use of the text is required verbatim and requires no additional DOE Approvals (pagination and format are excepted).

Attachment B

During the transfer on-Site of radioactive materials between facilities using a powered industrial truck (forklift), the following controls shall be met:

Applicability:

- SWBs containing ≤325 grams WG Pu (maximum 2 SWBs)
- One overloaded SWB with ≤410 grams WG Pu or
- TRU drums are prohibited for transfers
- LLW Boxes ≤3 g WG Pu (maximum 2 boxes)
- LLW Drums (maximum 4 drums)

Specific Controls or Restrictions for the use of powered industrial trucks for material transfers between facilities

1. Transfer of TRU SWBs is limited to between Buildings 440 to 664.
2. LLW drums and LLW Boxes transferred between nuclear facilities shall be transferred within an established area of the site. The established areas of the site are:
   - The 300 area
   - The 400 area
   - The 700 area (includes Buildings 559 and 569 as part of this area)
   - The 800 area

Credited Programmatic Elements for On-Site Transfer of Radioactive Materials Between Facilities Using Powered Industrial Trucks

Table 7-8.b Programmatic Transportation Controls for On-Site Transfer of Radioactive Materials Between Facilities Using Powered Industrial Trucks

1)	**Transfers of LLW using fossil fuel powered industrial trucks shall be limited to a maximum of 4 LLW drums or two LLW Boxes per move. LLW drums and LLW Boxes transferred between nuclear facilities shall be transferred within an established area of the site. LLW Boxes must be secured to the forklift. LLW drums must be palletized, except when moving a single drum at a time. LLW drums must be secured to the forklift.**
2)	**Requirements in the Site Transportation Safety Manual shall be followed.**
3)	**Propane powered forklifts or any type of crane shall not be used for the transfer of radioactive materials.**
4)	**The transfer of TRU SWBs using fossil fuel powered industrial trucks shall be limited to a maximum of two SWBs with ≤325 g WG Pu each or one overloaded SWB with ≤410 g WG Pu per move. SWBs must be secured to the forklift and must be palletized. The use of lifting lugs/pin-lifters is prohibited. Perform combustible load inspection along the route to ensure that there is no combustible packages >27 cubic feet within 10 feet or >1 gallon flammable liquid within 25 feet of the PIT during the transfer.**

- Due to their lower MAR values, all other LLW/LLMW forklift transfers using fossil fuel can be performed between nuclear facilities that are within an established area of the site. The established areas of the site are:
    - The 300 area
    - The 400 area
    - The 700 area (includes Buildings 559 and 569 as part of this area)
    - The 800 area

- Restricting areas permitted for TRU forklift transfers using fossil fueled vehicles reduces the potential for an accident. Because of their higher MAR value, TRU SWBs is limited to transfers between Buildings 440 to 664 because they are adjacent to each other. Transfers can be two SWBs with ≤325 g WG Pu each. If it is known that the SWB is overloaded, only one can be moved at a time. The analysis provides consequences for a move with up to 820 g WG Pu which is considered the worst case move for overloaded SWBs where the operator failed to determine the correct MAR prior to transfer. Combustible load control prevents large fires from occurring. Flammable liquids are packaged in accordance with the site Fire Protection Program Requirements. [See NSTR-003-01 Rev. 1*]

*NSTR-003-01, Rev. 1, Combustible Fuel Package Separation Distances, Kaiser-Hill Rocky Flats Environmental Technology Site.

RFO F 1325.8

United States Government

Department of Energy
Rocky Flats Field Office

memorandum

DATE: JUL 09 2002

REPLY TO ATTN OF: SP:NRD:RB:02-00974

SUBJECT: Approval of Appendix J, Safety Analysis Report (SAR) for Outdoor Waste Management, and Associated Page Change to the Site SAR

TO: Alan M. Parker
President & CEO
Kaiser-Hill Company, L.L.C.

Reference: 1. Letter, Brailsford to Mazurowski, 02-RF-00486, dtd 2/21/02, Subject: Transmittal of Site Safety Analysis Report (FSAR) Appendix J, Safety Analysis for Outdoor Waste Management, PGC-RFP-01.2226-MAN – MDB-014-02

2. Letter, Brailsford to Golan, 01-RF-01583, dtd 7/9/01, Subject: Notification of Discovery Issue on Use of the Building 779 Pad for Interim Storage of Radioactive Waste – MDB-162-01

The Department of Energy Rocky Flats Field Office (RFFO) has reviewed the Safety Analysis Report (SAR) for Outdoor Waste Management and associated page change to the Site SAR that was transmitted in reference 1. These changes to the Site SAR serve to resolve the discovery issue which was previously reported to the RFFO in reference 2. The SAR for Outdoor Waste Management and associated page change to the Site SAR are approved.

The RFFO bases for approval of these changes are provided in the attached Safety Evaluation Report (SER). The SAR for Outdoor Waste Management and associated page change to the Site SAR are approved upon incorporation of the technical direction provided in Appendix A to the attached SER. Should you have any questions, please feel free to contact Mr. Ron Bostic, at 2109.

Barbara A. Mazurowski
Manager

Attachment

cc w/Att:
M. Frei, EM-30, HQ
C. Gelles, EM-33, HQ
S. Stadler, EH-2, HQ
D. Owen, DNFSB, RFFO
R. Goldsmith, AMSP, RFFO
J. Schneider, AMP, RFFO
R. Bostic, NRD, RFFO
E. Westbrook, FAD, RFFO
M. Spears, K-H
A. Geis, K-H

SAFETY EVALUATION REPORT
ADDENDUM C

for

Site Safety Analysis Report, Appendix J
Safety Analysis Report for Outdoor Waste Management

Rocky Flats Environmental Technology Site
Kaiser-Hill, L.L.C.

PREPARED BY:

DEPARTMENT OF ENERGY
ROCKY FLATS FIELD OFFICE

Prepared by: _____ 7/2/02
Ronald Bostic, Director — Date
Nuclear Regulatory Division

Approved by: _____ 7-8-02
Barbara A. Mazurowski — Date
Manager

Reviewed for Classification/UCNI UNU
By: Lea Duran
Date: 7-10-02

TABLE OF CONTENTS

1.0 INTRODUCTION

On October 2, 2001, in response to a discovery issue on outdoor storage of waste on the Building 779 Pad, Kaiser-Hill, L.L.C. (K-H) transmitted for approval to the Rocky Flats Field Office a new safety analysis for outdoor waste management. The K-H submittal proposed substitution of the existing Site Safety Analysis Report (SAR) controls for the storage and staging of wooden waste boxes with a comprehensive safety analysis and associated control set. This new safety analysis and control set will be incorporated as Appendix J to the Site SAR.

Addendum C to the Safety Evaluation Report (SER) documents the Department of Energy (DOE) review and provides the rationale for the Rocky Flats Field Office (RFFO) approval of the Safety Analysis Report (SAR) for Outdoor Waste Management (Reference 1) and related page changes to the Site SAR. Along with the SAR for Outdoor Waste Management, Kaiser-Hill, L.L.C. (Kaiser-Hill) submitted a page change to Chapter 7, Site Controls, of the Site SAR which was submitted to RFFO via memorandum 02-RF-00486 dated February 21, 2002. This page change removes the controls for outdoor storage of wooden waste crates from Chapter 7 of the Site SAR. These controls will be superseded by the SAR for Outdoor Waste Management and its derived TSR controls which will be incorporated as Appendix J to the Site SAR.

This SER represents a complete evaluation of the SAR for Outdoor Waste Management (Reference 1) along with associated changes to the outdoor wooden waste crate controls in Chapter 7 of the Site SAR. The SER was prepared in accordance with the RFFO Desktop Procedure AME-ABD-01, *Nuclear Safety Oversight and Review Process for Authorization Basis Related Submittals* (Reference 4), which is based on the guidance provided in DOE-STD-1104-96, *Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports* (Reference 5).

2.0 SUMMARY CONCLUSION

On July 9, 2001, Kaiser-Hill notified the RFFO of a discovery issue involving the use of the Building 779 foundation pad as interim storage for low-level and SCO radioactive waste (Reference 2). Although the radioactive wastes were packaged in accordance with Site procedures, there was no inventory of radioactive material stored on the foundation pad. Therefore, the potential existed for the quantity of radioactive material to exceed the threshold for a hazard category 3 nuclear facility. Kaiser-Hill also committed to preparing a new safety analysis for outdoor waste management that would be incorporated into the Site SAR.

The SAR for Outdoor Waste Management (Reference 1) was developed per the "graded approach" application of DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports* (Reference 3). Subpart B of 10 CFR Part 830, *Nuclear Safety Management*, identifies this DOE Standard as a "safe harbor method" for preparation of FSARs for non-reactor nuclear facilities.

None of the accident scenarios evaluated in the SAR for Outdoor Waste Management exceeds the *Moderate* category. Scenario frequencies range from *anticipated* to *extremely unlikely*. Two of the unmitigated scenarios analyzed in the SAR for Outdoor Waste Management exceed Risk

Class III. However, with mitigation (i.e., inventory control) and prevention (i.e., route control for flammable liquid tanker trucks), these scenarios are reduced to Risk Class III. All other scenarios analyzed were either Risk Class III or IV for the collocated worker and public. Operational controls derived from these analyses consist entirely of administrative controls involving material management, inventory control, route control and safety management programs (SMPs). No safety structures, systems or components (SSCs) were credited. The Safety Analysis for Outdoor Storage identifies an adequate control set necessary to lower these risks to an acceptable level and to ensure safe facility operations. The accident analysis discussion in Section 4.2.2 of this SER provides further information.

With the addition of the attached "red-lined" changes, the RFFO concludes that the SAR for Outdoor Waste Management (Reference 1) adequately defines and documents the hazards and specifies the necessary controls. The administrative controls adequately reduce the risks to the public, collocated workers, and immediate workers to a level consistent with the guidelines provided in the Nuclear Licensing Streamline Initiative (Reference 10). In addition, the risks associated with outdoor waste management are consistent with those of other category 3 nuclear facilities at RFETS. Therefore, the RFFO approves the SAR for Outdoor Waste Management as submitted by Kaiser-Hill in Reference 1 subject to incorporation of the attached "red-lined" changes. The basis for this conclusion is presented in Section 4.0 of this SER.

3.0 REVIEW PROCESS

The RFFO review included federal and support contractor personnel with expertise in the nuclear safety, criticality safety, and fire protection disciplines. The RFFO review of the SAR and associated TSRs for Outdoor Waste Management focused primarily on the following areas:

- completeness and compliance with 10CFR830, Subpart B, and associated guidance and "safe harbor" methods,
- adequacy of the hazards and accident analyses and control set development,
- consistency with the agreement between Kaiser-Hill and the RFFO regarding authorization basis development (Reference 10), and
- resolution of the discovery issue regarding the use of the Building 779 foundation pad as interim storage for low-level and SCO radioactive waste (Reference 2).

Kaiser-Hill originally submitted the SAR for Outdoor Waste Management to the RFFO on October 2, 2001. Based on a review of this submittal, the RFFO prepared a list of 27 preliminary comments which were provided to Kaiser-Hill on November 2, 2001. These comments along with associated issues were discussed at a cross-table meeting with K-H held on November 7, 2001. During the cross-table meeting, K-H provided additional information regarding scope, waste management activities, hazards and analysis methods, and siting of waste management cells related to the SAR for Outdoor Waste Management. Based on RFFO's initial review and subsequent cross-table meeting with Kaiser-Hill, RFFO concluded that there were four major issues which needed to be resolved. These four major issues were included in 53 supplemental comments, which were emailed to Kaiser-Hill on November 13, 2001. The four major issues were as follows:

1. For the most part, only mitigated analyses were provided in the SAR. This made it difficult, if not impossible, to verify the adequacy of credited mitigation and prevention.
2. The SAR did not establish an upper limit on MAR for WMCs, but rather relied on segmentation of waste groups within each WMC for control of MAR.
3. No siting criteria were provided for WMCs that would establish the basic assumptions and constraints for locating WMCs (e.g., proximity to potential hazards such as propane tanks).
4. The safety analysis appeared to be inconsistent with other analyses in the Site SAR in terms of approach, potential consequences, and appropriate application of controls (e.g., Appendix D, Fuel Gas Systems).

Due to the large number of comments (i.e., 80 total) and the significance of the four major issues described above, RFFO proposed to partner with Kaiser-Hill on developing a resolution through a series of meetings. As proposed, the partnering process would start by addressing the four major issues in an effort to define a mutually acceptable approach to resolving nuclear safety issues with outdoor waste storage. The first partnering meeting with Kaiser-Hill was held on November 29, 2001 followed by a second on January 8, 2002.

The partnering between RFFO and Kaiser-Hill served to identify a mutually acceptable approach which was employed in the development of a new SAR for Outdoor Waste Management. This revised SAR was submitted to RFFO on February 21, 2002 for approval (Reference 1). RFFO performed a complete review of the re-submitted SAR for Outdoor Waste Management along with the page change to Chapter 7 of the Site SAR. Although this second RFFO review focused on verifying resolution of previous comments, some new issues were identified in particular with the analyses and TSRs. These new issues were discussed with Kaiser-Hill at cross-table meetings that were held on April 8 and 29, 2002. As a result of these meetings, RFFO and Kaiser-Hill came to agreement regarding resolution of the remaining issues. Kaiser-Hill subsequently chose to modify the SAR for Outdoor Waste Management and capture these modifications as "red-lined" changes which are attached to this report. These included changes to the SAR for Outdoor Waste Management that:

- clarified that the addition of new WMCs will require RFFO approval via page change to the SAR,
- clarified the scope of activities covered and potential impacts from other facilities and activities,
- modified WMC siting criteria to effectively mitigate the effects of flammable gas explosion (e.g., BLEVE),
- changed some of the assumptions in the fire scenario accident analyses including fuel quantity, airborne release fractions, damage ratios and particle size,
- eliminated other means of verifying compliance with administrative operating limits (AOLs) other than by conducting periodic WMC inventories, and
- introduced more rigorous and timely required actions when AOLs were not met.

4.0 APPROVAL BASIS

The SAR for Outdoor Waste Management (Reference 1) satisfies the requirements of Subpart B to 10 CFR 830, *Nuclear Safety Management*, for a Documented Safety Analysis and TSRs. The SAR was developed per the "graded approach" application of DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports* (Reference 3). Subpart B of 10 CFR Part 830, *Nuclear Safety Management*, identifies this DOE Standard as a "safe harbor method" for preparation of Safety Analysis Reports for non-reactor nuclear facilities.

There are no active or outstanding JCOs or USQDs that are currently applicable to outdoor waste management. However, as discussed in Section 2.0 of this SER, Kaiser-Hill did report to the RFFO a discovery issue regarding the outdoor storage of radioactive waste on the Building 779 foundation pad. This discovery issue precipitated the development of the SAR for Outdoor Waste Management. In addition, Kaiser-Hill performed an analysis of the impacts of a WMC obstructed gas cloud explosion resulting from a leaking propane tank or natural gas line. The conclusion of this analysis, which is documented in Reference 7, shows that the resulting overpressures would not be large enough to breach waste containers including wooden waste crates. Therefore, this scenario was not further evaluated in the SAR for Outdoor Waste Management. The RFFO disagreed with the conclusion that wooden waste crates would not be damaged as a result of a vapor cloud explosion. This issue is discussed further in Section 4.2.1.

Each WMC includes administrative safety controls and controls that reduce the risks to the public, collocated workers, and immediate workers to a level consistent with accepted risks at other Site facilities. Additional details, which form the bases for RFFO approval of the SAR for Outdoor Waste Management, are provided in the following sections of this SER. A summary of the SAR information including base information, hazards and accident analyses, and TSR derivation is also presented.

The approval bases are discussed in detail along with an assessment of the adequacy of the Safety Analysis for Outdoor Waste Management with respect to the requirements stated in each approval basis.

4.1 Adequacy of Base Information:

The base information contained in the Executive Summary, Chapter 1 (Introduction), and Chapter 2 (Outdoor Waste Management Activities) of the SAR for Outdoor Waste Management include descriptions of the following:

- WMC locations and layout including proximity to site hazards such as propane tanks and vehicle traffic,
- waste management operations and activities to be conducted in WMCs,
- natural phenomenon and man-made threats to WMCs, and
- identification of the individuals and organizations involved in the preparation, review, and approval of the FSAR.

The SAR for Outdoor Waste Management identifies 34 individual waste management cells (WMCs) each having a unique identifier and location description. There are currently no approved WMCs. However, the waste currently stored on the Building 779 foundation (proposed WMC-776-1) is an outdoor storage area currently operating under an approved interim control set included on the Site SAR Authorization Basis Document List. Kaiser-Hill also provided the RFFO with a map identifying the locations of the 34 WMCs. This information was used to evaluate the proximity to potential hazards including vehicle traffic, combustible materials, and flammable gases such as propane. The RFFO walked down several of the proposed locations to verify proper siting of designated WMCs. Siting criteria provided in the SAR for Outdoor Waste Management (including the Appendix A red-lined page changes), are as follows:

- WMCs will be located no less than 850 meters from the nearest Site boundary (minimum distance used for evaluating the dose consequences to the public),
- WMCs will be located no less than the following distances from propane storage tanks: 126 feet from 1,000-gallon tanks, 100 feet from 500-gallon tanks, and 90-feet from 250-gallon tanks (larger overpressures from a boiling liquid expanding vapor explosion – BLEVE and close-in turbulent gas jet explosion are not analyzed),
- WMCs will be located no less than 15 feet from natural gas distribution lines (minimizes the amount of vehicle and material handling equipment interaction that could cause a rupture of a distribution line),
- WMCs will not be located in a flood plain (flooding scenarios are not evaluated),
- WMCs will be located no less than 30 feet from active railroad tracks (impacts from a train accident are not evaluated), and
- WMCs will not be located adjacent to a road that is used by fuel delivery vehicles with a capacity greater than 400 gallons (reduces frequency of major fire).

WMCs will be used to store low-level and low-level mixed (LL/LLM) waste in various containers including 10-gallon drums, 55-gallon drums, wooden and metal Waste Boxes, cargo containers, and tankers. Un-containerized waste such as surface-contaminated objects (SCO) and low specific activity (LSA) may also be stored in WMCs. However, all un-containerized waste shall provide the same or higher level of integrity as other approved containers listed in AOL 1.3 of the SAR. Un-containerized waste consisting of plastic, cardboard, glass or other inferior materials shall require secondary containment (e.g., cargo container) for storage in a WMC. Operations and activities performed in WMCs will involve receipt, staging, storing, inspection, repackaging, certification, and shipping of waste containers. Repackaging activities in WMCs will typically be limited to those containers that are too large (i.e., >5520 lbs.) to move into an enclosed nuclear facility. Size reduction in support of repackaging or other WMC activities is not authorized under the SAR for Outdoor Waste Management.

Subsequent addition of new WMCs will require a USQ determination. In some cases, a new WMC may result in a negative USQD even though the new WMC is considered a Hazard Category 3 nuclear facility. However, based on discussions with Kaiser-Hill management, addition of new WMCs will require DOE RFFO approval to assure that there is documented DOE authorization for the new hazard category 3 nuclear facility. In order to clarify this

requirement, Kaiser-Hill provided changes to the SAR for Outdoor Waste Management which are attached as red-lined pages.

The Site SAR Appendix J does not evaluate the impact of a WMC adjacent to an existing Hazard Category 2 or 3 nuclear facility. Instead, each existing nuclear facility where a WMC may be close enough to present hazards that could affect the facility must perform a USQD against its existing authorization basis to assure that hazards and controls are properly addressed. Technical direction is being given that all negative USQDs to authorize WMCs that could affect an existing nuclear facility must be provided to RFFO for review prior to authorizing the specific WMC (Appendix A). Similarly, the addition of new WMCs to Appendix J in the future should include an evaluation of increased potential for accidents involving multiple WMCs. RFFO has included this issue as a comment to be considered in a future revision (Appendix C).

Conclusion: Based on a review of the SAR and walkdown of several WMCs, all base information is included and accurately presented. The facility's mission and scope of operations are clearly identified and consistent with those considered in the hazard and accident analyses. With the attached "red-lined" changes being approved per technical direction, the RFFO concurs with the base information.

In addition, since the Building 779 foundation is already storing wastes and is the subject of a discovery issue, Kaiser-Hill shall promptly implement the provisions of this SAR for this area. Technical direction to this effect is provided in Appendix B to this SER.

4.2 Adequacy of Hazard and Accident Analyses

The hazards and accident analysis contained in the SAR for Outdoor Waste Management was derived from the analysis in NSTR-001-02, Nuclear Safety Technical Report (NSTR) *Safety Analysis for Outdoor Waste Management* (Reference 6). This NSTR was developed consistent with supporting NSTRs including:

- *Applicable Airborne Release Fractions (ARFs) and Respirable Fractions (RFs) for Surface Contaminated, Combustible Waste in 55-Gallon Drums During Fires* (Reference 7),
- *Site Preliminary Hazards Analysis to Support Hazard Category 2 and 3 Nuclear Facilities' Authorization Basis Development* (Reference 8), and
- *Safety Analysis for Waste Management Activities* (Reference 11).

The Site Preliminary Hazards Analysis (Reference 8) provides the hazard evaluation for the immediate worker within the facility and additional identification of defense-in-depth controls for the immediate worker, collocated worker, and public. Collectively these NSTRs provide the basis for Chapter 4 (Hazard and Accident Analysis) and Chapter 5 (Technical Safety Requirements) of the SAR for Outdoor Waste Management. The process used to develop the hazards and accident analyses including the use of these NSTRs is discussed in the following sections of this SER.

In developing the SAR for Outdoor Waste Management (Reference 1), four risk classes of accident scenarios were defined: Risk Class I (Major), Risk Class II (Serious), Risk Class III (marginal), and Risk Class IV (negligible). The Risk Classes were based on a combination of the frequency of

occurrence and the consequences of the event as defined in the *Safety Analysis and Risk Assessment Handbook* (Reference 12). This approach to risk classification, which is applied to both radiological and chemical consequences, provides the basis for the development of TSR level controls and/or lower level administrative controls as a basis for risk reduction. For Risk Class I and II scenarios, TSR level administrative operating limits (AOLs) were credited to reduce the risk of the accident to a Risk Class III or IV. For the unmitigated analysis, Risk Class III or IV scenarios were not evaluated further for the purpose of TSR level control development, but rely on safety management program (SMP) level controls to address these hazards.

4.2.1 Hazards Analysis Review

The SAR for Outdoor Waste Management includes detailed analyses of nuclear, chemical and physical hazards and energy sources based on a Preliminary Hazards Analysis (PHA) technique. This hazards analysis includes the nuclear facility hazards categorization and identification of scenarios based on natural and man-made hazards and events. Table 3, Hazards Description Summary, of the SAR qualitatively evaluates each potential hazard along with its form and credited protective features as a basis for identifying accident scenarios that were analyzed further in NSTR-001-02 (Reference 6) and the SAR. The SAR identifies existing and potential hazards such as radioactive sources, radioactive wastes, chemicals, and non-material hazards (e.g., thermal energy sources, pressure sources, and electrical energy sources). The analysis of these hazards considers quantity, form, packaging, location, affected or affecting activities, and recognized preventive and mitigative features such as safety management programs (SMPs).

The SAR for Outdoor Waste Management includes a qualitative analysis of the consequences of accidents involving chemical and other hazardous materials. For WMCs that include wastes in liquid form, this analysis shows that a chemical release could result in adverse consequences to the MOI, collocated worker (CW), and immediate worker (IW). Exposures to these individuals are via inhalation and, in the case of the IW, skin absorption. The results of this evaluation are summarized in Table 5 of the SAR. In summary, none of the consequences exceed *moderate* for the MOI and CW. For the IW, consequences were determined to be *high* due to the possibility of short-term exposures of hazardous airborne chemicals in excess of the IDLH.

The nuclear hazard categorization for WMCs is based on the guidance provided in DOE-STD-1027-92, *Hazards Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* (Reference 9). Each of the 34 WMCs is classified as a category 3 nuclear facility. This classification is based on maintaining the inventory of Pu239 below 900g for each WMC. The higher 900g limit is used in lieu of the 450g limit for facility hazard categorization because the configuration and nature of operations in the WMCs precludes the potential for criticality. More specifically, a limit of 15g fissile is placed on individual waste containers stored in WMCs. This limit for individual containers exempts WMCs from the Site's Criticality Safety Program requirements per Reference 9. This exemption assumes an effective fissile material inventory program, which provides assurance the requirement is met.

The Site Preliminary Hazards Analysis (PHA) (Reference 8) supports the development of the AB documents for Hazard Category 2 and 3 nuclear facilities at the Site. This document summarizes hazard identification from a site-wide perspective for all nuclear facilities, including waste

handling, storage, and shipping activities. The Site PHA also documents unmitigated hazards analyses and identifies the suite of engineered and administrative controls available to prevent accident scenarios or mitigate accident consequences for the evaluated receptor. This PHA focused on the identification of controls to protect the immediate worker based on a qualitative assessment of frequencies, consequences, and risks to the immediate worker. From this suite of controls, a decision on whether any should be designated as a Safety Significant SSC or need TSRs to protect the immediate worker can be made. The SAR for Outdoor Waste Management concluded that no Safety Significant SSCs are needed to protect the immediate worker.

The SAR for Outdoor Waste Management also relies upon the hazards analysis presented in NSTR-001-02, *Safety Analysis for Outdoor Waste Management* (Reference 6), which applies a PHA technique to identify and evaluate the hazards and postulated accident scenarios associated with the types of activities performed in WMCs. Based on the information gathered during the hazards and controls identification process, determinations were made on whether further evaluation of specific hazards were necessary. This resulted in a spectrum of accident scenarios identified for further accident analysis. In general, no further evaluation was performed on those hazards that (1) could be characterized as Standard Industrial Hazards (SIHs) and (2) had limited impact on postulated accident initiation frequency, accident mitigation, and accident consequences. Industrial hazards that could lead only to occupational injury or illness were considered addressed by the Safety Management Programs which are discussed in Chapter 5 (Safety Management Programs) of the SAR for Outdoor Waste Management (Reference 1).

Eighteen representative scenarios from the Safety Analysis for Outdoor Waste Management (Reference 6) are listed in Table 9 of the SAR for Outdoor Waste Management. For each of the eighteen scenarios, frequencies and relative consequences are documented to provide comparative rankings. The SAR identifies existing and potential hazards such as radioactive sources, radioactive wastes, chemicals, and non-material hazards (e.g., thermal energy sources, pressure sources, and electrical energy sources). The analysis of these hazards considers quantity, form, packaging, location, affected or affecting activities, and recognized preventive and mitigative features such as Safety Management Programs (SMPs).

The RFFO reviewed the applicable accident scenarios in the Safety Analysis for Outdoor Waste Management (Reference 6) and the Site PHA (Reference 8) to evaluate whether the collective suite of controls were considered in the development of the SAR for Outdoor Waste Management (Reference 1). The RFFO concluded that the control set selection process adequately evaluated the suite of controls and were appropriately factored into the SAR for Outdoor Waste Management. The hazards analysis appropriately applies the "graded approach" for a Hazard Category 3 nuclear facility which handles and stores low-content Pu wastes such as LLW, LLMW, SCO and LSA material. In addition, the hazards analysis was determined to adequately address defense in depth, worker safety, environmental protection, and safety significant SSCs.

From the hazards analysis, specific accident scenarios were identified for further evaluation. The accident scenarios were binned into one of the following three general types of scenarios that could yield a radiological release: fire, spill and explosion. The accidents scenarios that were carried forward evaluated the following three types of initiators: operational or internal events,

natural phenomena events, and other external events such as a plane crash initiate these three general types of scenarios. Consideration was given to both potential consequences and frequency when identifying scenarios for further analysis. Of the eighteen scenarios that were evaluated in the hazards analyses, seven were selected for the accident analysis, these are discussed further in the Accident Analysis Review in Section 4.2.2 of this SER.

External explosion hazards from flammable gases were evaluated in the hazards analysis and screened out from further evaluation based on: 1) WMC siting criteria which would eliminate the potential damage from a turbulent gas jet detonation 2) waste containers could not be breached by the approximate 1 psig overpressure from an unconfined vapor cloud explosion (Reference 7), and 3) the consequences of a BLEVE would be no worse than those of the analyzed seismic event (NPH Scenario 1). Based on Appendix D (Fuel Gas Systems) of the Site SAR and supporting calculations, RFFO disagreed with the Kaiser-Hill rationale for screening out explosions for further analysis. The safety analysis provided in Appendix D of the Site SAR indicates significant overpressures may result from BLEVE, turbulent jet and vapor cloud explosions to the extent that wooden waste crates would be significantly damaged at distances of 100 ft or more from such explosions. Based on the Appendix D analysis, RFFO questioned the adequacy of the 15 ft. separation distance from propane tanks, which was specified as a siting criterion in the SAR for Outdoor Waste Management. In particular, RFFO concluded that a minimum separation distance of 80 ft would be necessary to prevent wooden waste crate damage from a BLEVE. As a result, Kaiser-Hill agreed to revise the hazards analysis and siting criterion to address these remaining issues with flammable gas explosions. The revised siting criterion, which is listed in the second bullet on page 5 of this SER, provides adequate separation between propane tanks and WMCs to prevent damage to waste containers in the event of BLEVE or other explosion involving propane. These modifications were incorporated in the attached "red-lined" changes to the SAR (see Appendix A technical direction) and to NSTR-001-02 (Reference 6).

4.2.2 Accident Analysis Review

As discussed in Section 4.2.1, the hazards analysis scenarios that were selected for further evaluation in the accident analysis are as follows:

1. Major Waste Container Fire (involving 8,500 gallons of diesel fuel)
2. Non-aqueous (e.g., flammable) Liquid Waste Fire
3. Crane Load Drop Resulting in Spill
4. Seismic-Induced Structural Failure
5. Lightning Breach
6. Aircraft Crash
7. Ground Vehicle Impact

The accident analysis methodology is based on the methods and Evaluation Guidelines established by the Nuclear Licensing Streamline Initiative (Reference 10). This includes application of ICRP 68 dose conversion factors and higher Evaluation Guidelines than previously applied for approval of SAR and annual updates. Radiological consequences are based on 100 m for the collocated Worker (CW) and 850 m for the Maximum Offsite Individual (MOI). Doses are based on the Site WG Pu isotopic mix identified in Reference 12.

Binning was performed to identify the more severe (i.e., bounding) accidents that were qualitatively evaluated in the hazards analysis. For the WMCs, the SAR for Outdoor Waste Management identified the major waste container in a fuel pool fire and non-aqueous waste container fire as bounding for the CW and MOI. These bounding scenarios along with the other five quantitatively analyzed scenarios are discussed in the following paragraphs:

Major Waste Container Fire: This scenario originally postulated a diesel fuel delivery truck that is involved in a collision spilling 5,000 gallons of diesel. This scenario was later revised to involve an 8,500 gallon spill based on the largest fuel delivery truck received at the Site. The spilled fuel area was increased to approximately 35,000 ft^2 that engulfs an entire WMC. The Airborne Release Fraction (ARF) for this scenario was revised to address the potential ejection of lightweight combustible materials and unconfined burning with an ARF of 1E-2. However, due to the prolonged nature of this fire, the scenario conservatively assumes that the material not ejected behaves as unconfined burning due to the degradation of the waste container. This material is more conservatively modeled as unconfined plastics with an ARF of 5E-2. The material at risk (MAR) for this scenario is 900g weapons grade (WG) Pu equivalent, which is also a TSR control limit for the WMC. Without prevention, the consequences for this scenario are *moderate* to the CW (10.0 rem) and MOI (0.97 rem). The frequency for this scenario, without prevention, is *unlikely*. This results in an unmitigated Risk Class II event for both receptors, which warranted further consideration for TSR controls. As a result, route control for large fuel delivery trucks is credited as prevention, which alone reduces the frequency to *extremely unlikely*. No route control surveillance is identified in the TSRs since verification of this control is not conducive to verification via surveillance and is already addressed through periodic assessment of the SMP. Since the Site SAR already has TSR level controls for on-site transportation of fuels (STC 4), the SAR for Outdoor Waste Management references this existing control. With prevention, this scenario is reduced to Risk Class III event for both the CW and MOI. No defense-in-depth controls were identified for this scenario since no practical controls could be applied that would further reduce risk. The attached red-lined page change addresses the fuel quantity and size, ARF, and route control revisions (Appendix A).

It should also be noted that this fire is slightly different than the Maximum Possible Fire Loss (MPFL) evaluated in the Fire Hazards Analysis (Reference 13). The MPFL is based on involving two WMCs each with 900g Pu that drives the economic cleanup cost estimate. The SAR argues that involving two WMCs would actually result in less release and dose consequences because the lower 5E-4 ARF would be assumed for the non-ejected MAR because of the shorter duration fire that would not destroy the waste containers. Therefore, this difference between the MPFL and SAR scenarios is appropriately justified.

Non-aqueous Liquid Waste Fire: This scenario postulates a fire involving non-aqueous (e.g., flammable) liquid wastes such as organic solvents and oils. The fire propagates from container to container engulfing the entire WMC. The frequency for this scenario, without prevention, is *anticipated*. The material at risk (MAR) for the unmitigated case is 900g weapons grade (WG) Pu equivalent. For the unmitigated scenario, the

consequences for this scenario are *moderate* to the CW (22 rem) and MOI (2.1 rem). This results in an unmitigated Risk Class I event for both receptors, which warranted further consideration for TSR controls. As a result, an additional inventory control of 150g weapons grade (WG) Pu equivalent in a non-aqueous liquid waste form for WMCs is credited. With mitigation in the form of inventory control for non-aqueous liquid waste, the consequences (3.6 rem CW and 0.35 rem MOI) are reduced to a Risk Class III event for both the CW and MOI. No defense-in-depth controls were identified for this scenario since no practical controls could be applied that would further reduce risk.

Crane Load Drop Resulting in Spill: During handling by a crane, a large waste container is dropped on another breaching both containers. Four additional containers are also impacted by the dropped container resulting in the breach of a total of six large waste containers each assumed to contain 15g WG Pu. The MAR for this scenario is 90g, and the frequency is *anticipated*. The consequences for this scenario are *low* (0.31 rem CW and 0.01 MOI) resulting in a Risk Class III event without mitigation. No specific controls are credited for this scenario other than the specific SMPs identified in Chapter 3 of the SAR for Outdoor Waste Management.

Seismic-Induced Structural Failure: An earthquake is postulated to cause the collapse of an adjacent structure or structures resulting in the breach of all stored waste containers. This scenario is applicable only to some of the 34 WMCs. The WMCs affected include WMC-707-2, WMC-776-2, WMC-776-3, WMC-776-4, WMC-776-5, WMC-776-6, WMC-559-4, WMC-371-3, and WMC-MS-6. The frequency of this event is assumed to be *unlikely* based on the seismic history of the region. Since all containers in the WMC are involved, a MAR of 900g WG Pu is assumed involved in the confined spill with an ARRF of 1E-4. As a result, the consequences of this event are *low* (3.1 rem CW and 0.1 rem MOI) resulting in a Risk Class III event without mitigation. Other than the 900g WG Pu inventory limit, no specific controls are credited for this scenario other than the SMPs identified in Chapter 3 of the SAR for Outdoor Waste Management.

Lightning Breach: This scenario involves a large waste container being struck by lightning causing rapid heating of it contents including any residual liquids, which could result in rapid pressurization and rupture of the container. The frequency of this event is judged to be *anticipated* for those WMCs that are not in close proximity to high profile objects. For those WMCs which are in close proximity to high profile objects, the frequency is reduced to beyond extremely unlikely. The MAR for this scenario is 15g WG Pu (i.e., one box or cargo container). The consequences of a lightning strike are *low* (0.73 rem CW and 0.03 rem MOI) resulting in a Risk Class III event (assuming *anticipated* frequency). No specific controls are credited for this scenario other than the SMPs identified in Chapter 3 of the SAR for Outdoor Waste Management.

Aircraft Crash: The aircraft crash scenario results in a 800 ft^2 fuel pool fire that spreads ultimately involving the entire WMC (assuming the WMC consists of wooden waste crates only). The frequency of such a crash is considered to be *extremely unlikely*. Since all containers in the WMC are involved, a MAR of 900g WG Pu is assumed. If multiple WMCs were involved, fewer containers would be breached effectively lowering the

MAR. The crash impact is assumed to breach 25% of all the containers and result in an unconfined material release from the fire, with the remaining 75% modeled as confined material fire releases. The consequences of this event are *low* (4.8 rem CW and 0.4 rem MOI) resulting in a Risk Class IV event without mitigation. Other than the 900g WG Pu inventory limit, no specific controls are credited for this scenario other than the SMPs identified in Chapter 3 of the SAR for Outdoor Waste Management.

Ground Vehicle Impact: This scenario postulates that a vehicle such as personal automobile, truck, or emergency response crashes into a WMC breaching 10% of the containers. The frequency for this scenario is *anticipated*, and the MAR is 900g WG Pu. The consequences of this event are *low* (0.3 rem CW and 0.01 rem MOI) resulting in a Risk Class III event without mitigation. Other than the 900g WG Pu inventory limit, no specific controls are credited for this scenario other than the SMPs identified in Chapter 3 of the SAR for Outdoor Waste Management.

The assumptions of the accident scenarios as documented in the waste activities NSTR-001-02 (Reference 6) are generally consistent with the NSTR-010-01 (Reference 11) evaluation for TRU and LLW wastes. Any apparent differences were discussed during the review process and resolved in the final submittal. Two of the scenarios (the fire involving 8,500 gallons of diesel fuel and the fire involving non-aqueous liquid waste) have unmitigated risks that exceed Risk Class III for the CW and MOI. Therefore, consideration of additional TSR controls is warranted thereby reducing the risk to the CW and MOI to Risk Class III. The risk of all other accidents that are unmitigated Risk Class III or IV are adequately addressed by the TSR ACs and the TSR commitment to SMPs.

Conclusion: Overall, the hazards and accident analysis is comprehensive and thorough, and evaluates a spectrum of scenarios in order to provide a defendable basis for required controls and development of TSRs. In addition, the hazard categorization for the WMCs is adequately determined and justified. With the attached "red-lined" changes being approved per technical direction, the RFFO concurs with the hazards and accident analyses, and the facility hazards categorization.

4.3 Adequacy of Derivation and Development of Technical Safety Requirements:

Each accident scenario identified in Section 4.5 of the SAR identifies credited preventive and mitigative features. These features are appropriately classified and safety functions are delineated in Chapter 5 (Technical Safety Requirements). As discussed in section 4.2.2 of this SER, unmitigated Risk Class I and II scenarios resulted in the development of TSR administrative controls. However, no unmitigated consequences exceeded the Safety Class Evaluation Guideline of 5 rem to the public (Reference 10). For the unmitigated Risk Class III or IV scenarios, no further evaluation was performed since these scenarios do not result in unmitigated consequences higher than *moderate*. The risks associated with all of these scenarios are adequately controlled by TSR administrative operating limits (AOLs) and SMPs. No safety class or safety significant SSCs are associated with WMCs.

Along with the SAR for Outdoor Waste Management, Kaiser-Hill submitted a page change (PGC-RFP-01.2226-MAN) to Chapter 7 of the Site SAR which was included in reference 1.

Once the TSRs for outdoor waste management are approved and implemented, the current Chapter 7 controls on wooden LLW crates will be deleted from the Site SAR. Based on the analysis presented in NSTR-001-02 and the SAR for Outdoor Waste Management, the unmitigated consequences and risks no longer drive the need for these wooden waste crate TSR level controls. This is primarily due to a change in methodologies as permitted in the Nuclear Licensing Streamline Initiative (Reference 10) which allowed the use of higher Evaluation Guidelines and lower dose conversion factors from ICRP 68. The new analyses are consistent with the evaluation of TRU waste facilities applying the same methodology. The Outdoor Waste Management TSR ACs and commitment to SMPs are adequate for outdoor storage of wooden waste crates.

The RFFO review determined that the surveillance requirements for verification of AOLs 1.1 and 1.2 were inadequate. Theses surveillances (SRs 5.6.1 through 5.6.7) would not be required in the event that some other, unspecified method was used to verify compliance with AOLs 1.1 and 1.2. Changes to these SRs were identified and incorporated in the attached "red-lined" changes (see Appendix A technical direction).

As previously discussed in Section 4.2.2 of this SER, the SAR for Outdoor Waste Management references STC 4 as a TSR level control on the routing of fuel delivery vehicles. As described in the accident analysis, this control is intended to prevent fuel delivery vehicles (> 400 gal.) from driving on WMCs or on roads adjacent to WMCs. However, STC 4 is not specific with regards to any such limitations. As a result, Kaiser-Hill proposed modifications to STC 4. These modifications were incorporated in the attached "red-lined" changes (see Appendix A technical direction).

The Site SAR Appendix J Section 4.9 derivation of TSRs does not present the correlation of the control to the hazards and accident analysis. Since there are only three AOLs and the commitment to SMPs, this was deemed adequate for a graded hazards category 3 facility. The TSR Bases provide adequate linkage between the controls and the hazards and accident analyses.

Conclusion: With the attached "red-lined" changes being approved per technical direction, the RFFO concurs with the proposed control set. The TSRs were determined to prescribe an adequate set of controls consistent with the accident analysis and sufficient to maintain the operational safety envelope for each WMC.

4.4 Adequacy of Programmatic Controls

Programmatic controls encompass the elements of institutional programs and facility management that are necessary to ensure safe operations based on assumptions made in the hazards and accident analyses. In the SAR for Outdoor Waste Management, programmatic controls are identified as Safety Management Programs (SMPs) in Chapter 3.

The Safety Management Programs described in Chapter 3 of the FSAR provide both worker protection and defense-in-depth. The SAR identifies 17 site-wide SMPs that are implemented within each WMC. Of these 17 SMPs, the SAR specifies 9 that are important to provide defense in depth with respect to the hazards and accident analyses. Administrative Control (AC) 5.7, Safety

Management Programs, is identified as a TSR level control. In addition, the Safety Management Programs will be enforced through the Price Anderson Amendment Act.

5.0 REFERENCES

1. *Safety Analysis Report, Appendix J, Safety Analysis for Outdoor Waste Management*, Revision 0, February 2002, Kaiser-Hill Company, Rocky Flats Environmental Technology Site, Golden, CO.
2. Memorandum, Brailsford to Golan, 01-RF-01583, "Notification of Discovery Issue on Use of the Building 779 Pad for Interim Storage of Radioactive Waste – MDB-162-01," July 9, 2001, Kaiser-Hill, L.L.C., Rocky Flats Environmental Technology Site, Golden, CO.
3. *Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, DOE Standard DOE-STD-3009-94, U.S. Department of Energy, Washington, D.C., July 1994.
4. *Nuclear Safety Oversight and Review Process for Authorization Basis Related Submittals*, AME-ABD-01, Revision 0, DOE/RFFO Desktop Procedure, September 1, 1998.
5. *Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports*, STD-1104-96, U.S. Department of Energy, Washington, D. C., February 1996.
6. *Safety Analysis for Outdoor Waste Management*, NSTR-001-02, Nuclear Safety Technical Report, Kaiser-Hill, L.L.C., Revision 0, April 2002.
7. Unreviewed Safety Question Determination, USQD-RFP-02.0352-ARS, *Obstructed Gas Cloud Explosions*, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, April 17, 2002.
8. *Site Preliminary Hazards Analysis to Support Hazard Category 2 and 3 Nuclear Facilities' Authorization Basis Development*, NSTR-007-01, Nuclear Safety Technical Report, Kaiser-Hill, L.L.C., Revision 0, May 2001.
9. *Nuclear Criticality Safety Manual*, MA-088-NCSM, Revision 3, Rocky Flats Environmental Technology Site, Golden, CO, November 30, 2000.
10. Memorandum, Mazurowski to Card, AME:NRD:MP:00-02784, "Authorization Basis Development," June 12, 2000, U.S. Department of Energy, Rocky Flats Field Office, Golden, CO.
11. *Safety Analysis for Waste Management Activities*, NSTR-010-01, Nuclear Safety Technical Report, Kaiser-Hill, L.L.C., Revision 0, June 2001.
12. *Safety Analysis and Risk Assessment Handbook* (SARAH), RFP-5098, Revision 2, Rocky Flats Environmental Technology Site, Golden, CO, December 1999.
13. *Fire Hazards Analysis, RCRA Units and Waste Management Cells*, FHA-RCRAWMC-001, Rocky Flats Environmental Technology Site, Golden, CO, February 11, 2002.

APPENDIX A
DIRECTED CHANGES TO THE SITE SAR APPENDIX J

The following list presents changes that must be made to the Site SAR Appendix J and TSRs as a condition for the Rocky Flats Field Office (RFFO) approval of the document.

1. The proposed Page Change to authorize outdoor storage of LLW is approved as submitted except for the "red-lined" revisions included in the attachment to this SER Addendum that need to be incorporated into the SAR and TSRs. As long as the attached "red-lined revisions are used verbatim (other than pagination or minor document production changes), no further DOE approval is required.

2. Kaiser-Hill shall submit all negative USQDs to RFFO 30 days prior to authorizing a WMC that could affect an existing Hazard Category 2 or 3 nuclear facility (excluding other WMCs).

APPENDIX B
ISSUES TO BE ADDRESSED UPON SITE SAR APPENDIX J IMPLEMENTATION

The following list presents issues that shall be resolved during implementation of the Site SAR Appendix J.

1. For WMC-776-1, Kaiser-Hill shall implement the provisions of this SAR within 90 days of the date of approval of this SER.

APPENDIX C
COMMENTS TO BE CONSIDERED IN A FUTURE UPDATE

The following list is not technical direction. The items listed below are items that the contractor should take into consideration and determine in a future revision.

1. Based on the locations and configurations of each of the 34 WMCs in the SAR for Outdoor Waste Management, RFFO agrees with the Kaiser-Hill analysis which demonstrates that an event involving MAR in excess of 900 g (i.e., one WMC) is not credible. As a result, RFFO concluded that scenarios involving multiple WMCs did not need to be analyzed. However, as additional WMCs are added via SAR page change, scenarios involving more than one WMC may become credible and, therefore, should be analyzed. In the future, each time a new WMC is added to Appendix J, Kaiser-Hill should re-evaluate the possibility of an event (e.g., fire) involving more than one WMC. If events involving more than one WMC become credible based on the location of a new WMC, Kaiser-Hill should revise the supporting hazards and accident analyses as appropriate.

Attachment

**RFFO Approved "Red-lined" Changes
to the Site SAR Appendix J
and the TSRs**

EXECUTIVE SUMMARY

This safety analysis provides the final hazard classification and Authorization Basis documentation for Outdoor Waste Management at the Rocky Flats Environmental Technology Site (Site). Justification is provided for categorizing areas of the Site as Hazard Category 3 "facilities" called Waste Management Cells (WMCs). These WMCs are specific areas in which Outdoor Waste Management activities may be performed. The WMCs are identified and described in Section 2.2, *WMC Descriptions* and are evaluated in this safety analysis.

Department of Energy (DOE) documents (Refs. 1, 2, and 3) mandate that safety evaluations be performed for nuclear facilities within the DOE nuclear complex that have the potential to adversely affect the health and safety of the workers, the public, or the environment. The controls listed in Section 5, *Technical Safety Requirements* are placed on WMCs to maintain a Hazard Category 3 designation and prevent the introduction of materials that would invalidate the safety analysis basis documented herein.

A readiness determination will be performed prior to start-up of waste management activities at a WMC, and will include verification of compliance with the controls listed in Section 5, *Technical Safety Requirements*. ~~The DOE-RFFO will be notified of any new WMCs that are intended to be used for Outdoor Waste Management prior to waste management activities being performed at them.~~ Department of Energy - Rocky Flats Field Office (DOE-RFFO) approval of a page change to this Appendix J is required to add a new WMC.

The accident scenario results for each of the bounding cases are summarized in Table 1, *Bounding Accident Scenario Results*.

Table 1 Bounding Accident Scenario Results

Accident Scenario	Frequency	Radiological Dose (rem)		Risk Class	
		CW	MOI	CW	MOI
1. Major Waste Container Fire ~~5,000~~8,500 Gallons of Diesel Fuel, 1 WMC	Extremely Unlikely	1.~~1~~E0E+1 Moderate	9.7~~1.1~~E-1~~+0~~ Moderate	III	III
2. Major Waste Container Fire Non-Aqueous Liquid Waste Fire	Anticipated	3.6E-0 Low	3.5E-1 Low	III	III
3. Spill Crane Load Drop	Anticipated	3.1E-1 Low	1.1E-2 Low	III	III
4. NPH Seismic-Induced Structural Failure	Unlikely	3.1E+0 Low	1.1E-1 Low	III	III
5. NPH Lightning Breach	Anticipated	7.3E-01 Low	2.6E-02 Low	III	III
6. External Event Aircraft Crash	Extremely Unlikely	4.8E+0 Low	4.1E-1 Low	IV	IV
7. External Event Ground Vehicle Impact	Anticipated	3.1E-01 Low	1.1E-02 Low	III	III

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identification/evaluation and accident analysis are consistent with NSTR-010-01, *Safety Analysis for Waste Management Activities* (Ref. 5). The storage/handling (SH), generation of waste (GN), and routine activity (RA) modules as defined in NSTR-010-01 are the applicable activity modules for the scope of this safety analysis.

The MAR assumptions used for this safety analysis are consistent with the nature and objectives of the Outdoor Waste Management mission. The activities will be conducted through Site closure, and waste will be generated from D&D facilities and ER projects. The waste stored outdoors is waste intended to be shipped offsite. There may be occasions when packaged waste items are found to be overloaded (*i.e.*, greater than the limits imposed in Section 5, *Technical Safety Requirements*). This safety analysis evaluates higher gram amounts to account for these potential situations, but does not permit the configuration as part of normal routine operations. A required action to remove overloaded packaged waste items from the waste storage area to an authorized area, or to restore compliance within a specified time frame is defined in these cases. The per-container inventory limits are based on the standard Site LLW/LLMW package values and transportation values for SCO and bulk LLW items.

This safety analysis considers accident initiators unique to Outdoor Waste Management activities. For example, accidents involving large quantities of flammable liquids associated with tractor/trailers and fuel delivery vehicles must be considered in the midst of outdoor waste storage arrays. Liquid waste forms (including non-aqueous liquids such as solvents, oils, *etc.*) are also unique in terms of the quantities involved. Lightning as an accident initiator is also unique in that waste containers may be stored away from building structures such that they are not "shielded" by the structure from direct lightning strikes. This AB document provides a bounding set of representative accident scenarios with a set of controls to safely manage waste outdoors.

This safety analysis provides authorization, from a nuclear safety standpoint, for the outdoor management of radioactive waste (including LLW/LLMW, SCO, and LSA materials), and for the outdoor storage of contaminated wastewater or organic solutions. The transfer and shipment of waste materials is addressed separately in Chapter 8, *Transportation Safety Analysis*, of the Site SAR (Ref. 4). Activities involving ~~conducted~~packaged waste on ~~the~~ a facility loading dock ~~of a facility are is~~ are ~~covered~~ evaluated ~~either under either~~ in the facility-specific Authorization Basis (AB) document(s). Activities involving packaged waste ~~-~~at a facility loading dock (*i.e.*, loaded on a transfer vehicle) is evaluated ~~or under~~ in the Site SAR Transportation Safety Analysis.

This safety analysis also provides authorization for the packaging and repackaging of waste not involving externally contaminated packages. Large containers such as cargo containers or truck trailers may require repackaging in response to an out-of-compliance condition with the AB or Waste Acceptance Criteria (WAC). Such containers are typically too large to move into a facility and are packaged/repackaged outdoors. The packaged waste destined for these large containers are typically packaged to support radiological release criteria and are not externally contaminated. This type of waste can be packaged/repackaged outdoors in accordance the Radiological Protection Program. Smaller containers (*e.g.*, drums, wooden waste boxes, *etc.*) may require that all barriers to the contaminated waste (*i.e.*, packaging materials) be breached in order to repackage the waste. These containers are typically packaged/repackaged inside facilities as additional confinement may be necessary in order to minimize the spread of contamination. While the accidents associated with the

be necessary in order to minimize the spread of contamination. While the accidents associated with the unconfined packaging and repackaging of externally contaminated waste are equivalent to those analyzed in this safety analysis, the corresponding normal operational releases associated with that activity are not analyzed.

If a waste container exceeds the applicable bounding safety analysis values defined in this document, repackaging and/or storage of the containers must be evaluated on a case-by-case basis. The containers may also be subject to requirements under the Criticality Safety Program if the bounding safety analysis values are exceeded.

Outdoor Waste Management is intended to cover radioactive material packages with low Pu content but can also include packages with uranium. Low Pu content waste is intended to cover waste that is generally designated as LLW/LLMW, SCO, or LSA material. Due to the significant differences between radiological dose consequences for Pu and uranium, packaged waste can contain significantly larger amounts of uranium and remain bounded by the Pu package nuclear safety analyses. However, storage of uranium waste is subject to the requirements of the Criticality Safety Program.

Designated areas in which radioactive packaged waste is stored are referred to as Waste Management Cells (WMCs). The WMCs are identified and described in Section 2.2, *WMC Descriptions* and are evaluated in this safety analysis. Controls are placed on WMCs to maintain a Hazard Category 3 designation and prevent the introduction of materials that would invalidate the safety analysis basis documented herein. A readiness determination will be performed prior to start-up of waste management activities at a WMC, and will include verification of compliance with the controls listed in Section 5, *Technical Safety Requirements*. DOE-RFFO approval of a page change to this Appendix J is required to add a new WMC. ~~The DOE-RFFO will be notified of any new WMCs that are intended to be used for Outdoor Waste Management prior to waste management activities being performed at them.~~

The safety analysis uses a hazard identification checklist and description table to provide the framework for the hazard evaluation. Standard industrial hazards are not analyzed further unless they initiate a release of hazardous materials or worsen the consequences of a hazardous material release. This safety analysis is intended to provide the bounding analyses for Outdoor Waste Management at the Site.

Potential accidents associated with Outdoor Waste Management activities (*e.g.*, fuel pool fires, ground vehicle impacts) that could negatively impact an adjacent Hazard Category 2 or 3 Nuclear Facility are either (1) analyzed in facility-specific AB document(s) or (2) must be screened against both the facility AB document(s) and this Site SAR Appendix J using the Unreviewed Safety Question Determination process. This Site SAR safety analysis evaluates potential impacts ~~that~~ that a structure (including a Hazard Category 2 or 3 Nuclear Facility) ~~adjacent to~~near a~~area where Outdoor Waste Management activities are being conducted~~ WMC has on the ~~Outdoor Waste Management activities~~WMC. For instance, a seismic event could cause a nearby structure to fall onto packaged waste items stored on a WMC.

The larger waste containers (*e.g.*, cargo containers, Industrial Package (IP)-2s, *etc.*) would generally have larger net weight capacities and would therefore have a larger allowable Pu content than the 3 grams associated with standard boxes and crates and the safety analysis sets their limit to 6 grams which is consistent with Department of Transportation (DOT) limits for specific types of shipments. The Site generally associates the 6 gram limit with SCO waste material limits.

Bulk storage of aqueous waste in tanker trucks supports collection of wastewater from onsite waste transfer stations and the pumping/collection of aqueous waste from valve vaults, excavations, and manholes or other locations. In addition, the bulk storage of organic waste in tanker trucks supports collection of the solutions from onsite containers or tanks in preparation for removal of the waste solutions from the Site. The contaminated low Pu content wastewater or organic solutions will be stored in tanker trucks that could have a capacity of ~~5,000~~8,500 gallons, and also will be stored in waste drums.

~~1.1.~~2.1.2 Waste Generation (GN)

The Waste Generation module involves the generation of radioactive waste (including LLW/LLMW, SCO, and LSA materials) or HAZ during incidental spill cleanup, construction, and decontamination and decommissioning (D&D) activities. Waste containers are packaged and filled as a normal activity within the Waste Generation module.

The hazards and accident analyses specific to Waste Generation are bounded by the SH activity analyses. Waste container receiving, handling and storage activities in support of this module are addressed in the SH module discussion above. Routine activities responsible for the generation of waste (*e.g.*, construction, maintenance, repair *etc.*) are addressed in the Routine Activities module below.

~~1.1.~~2.1.3 Routine Activities (RA)

The Routine Activities module involves only those activities generally necessary to support day-to-day conduct of outdoor waste storage activities (e.g., maintenance, construction, surveillance, and general housekeeping required for control of combustible and hazardous materials). Primary waste container packaging is not breached under normal operating conditions in the Routine Activities module. The hazards and accident analyses specific to Routine Activities are evaluated as part of the safety analysis.

Maintenance activities may include use of heavy equipment for grading, paving or other surface preparations, and repair work on transport vehicles or cargo containers, *etc.* Construction includes Integrated Work Control Program (IWCP) activities including modifications to or expansion of waste storage surfaces (*i.e.*, asphalt or gravel pads, *etc.*). These activities include grading, paving, or other surface preparations.

Surveillance activities predominately consist of routine WMC operator rounds, including maintenance of logs and records; security force tours and response actions; and programmatic inspections and audits (*e.g.*, environmental compliance assessments, fire protection and radiological protection surveys, and audits from federal, state and local authorities).

~~1.~~22.2 WASTE MANAGEMENT CELL (WMC) DESCRIPTIONS

The locations and descriptions of designated WMCs are provided in Table 2. Each of the WMCs will meet the siting criteria identified in Section 3, *Safety Management Programs,* as derived in Section 4, *Hazards and Accident Analysis.*

Table 2 WMC Descriptions

Designation	Description
WMC-371-1	Area located west of Building 371 in a north-south orientation between two roads, beginning at the intersection of roads near the southwest corner of the building and extending to the north and northeast between the two roads to the point where the interior road (main building-access road) turns due east.
WMC-371-2	Area located north of the northeast corner of Building 371 and north of Building 374 in the location previously occupied by the Building 374 potassium hydroxide tanks, nitric acid tanks, process wastewater tanks, cement silo, and associated ancillary equipment and buildings. This WMC extends from west to east, 30 feet north of Buildings 371 and 374 and south of the main building-access road on the north side of the Protected Area (PA), beginning at the dock 18T access road and ending at the north-south road on the east side of Building 374.
WMC-371-3	Area located north of Building 371 extending from west to east, 30 feet north of Building 371 and south of the main building-access road on the north side of the PA, beginning to the north of Door 20 and extending eastward to the dock 18T access road.
WMC-371-4	Area located north of Buildings 371 and 374 extending west to east between the main building-access road and the minor road located at the slope break of the hill extending down to the north access road. This WMC extends from the north-to-east turn in the main building-access road to the eastern side of the north-south road on the east side of 374.
WMC-707-1	This WMC consists of two areas located on the west side of Building 707 (each area is about 40 feet wide by 110 feet long). These areas are located west of the paved road on the west side of Building 707, east of Building 564, along roadway beside utility pole D5-364, and along roadway beside utility pole C5-362.
WMC-707-2	Area 50' x 60' east of and immediately adjacent to the foundation of the 709 cooling tower location.~~Area that encompasses the footprint of the old 709 cooling tower basin/pad (after cleanup of the demolished cooling tower). This area will have to be graded or modified to preclude flooding prior to use.~~
WMC-707-3	Area located within a 30-ft wide perimeter of the outside walls of Building 707 and 778 and ending at the interface between B778 and 776/777.

Waste Management Activities. Therefore, depleted and enriched uranium are not isotopes of concern for this Hazard Category determination.

The gram inventory threshold between a Hazard Category 3 Nuclear Facility and a Hazard Category 2 Nuclear Facility for americium-241 is 16 grams. ~~A Waste and Environmental Management System (WEMS) query listing all LLW/LLMW containers yielded over 20,000 containers. The total amount of americium-241 in all of the LLW/LLMW containers with credible, reported americium values was approximately 2.5 grams, far less than the 16 gram threshold even though it includes all of the LLW/LLMW at the Site.~~ At Rocky Flats, high americium wastes do not fall in the category of LLW (Ref. 7). Therefore, americium-241 is not an isotope of concern for this Hazard Category determination.

The final Hazard Category determination is provided in Section 4.8, *Final Hazard Classification.*

~~1.1.1.~~93.1.2.9 Waste Management

The hazard evaluation relies upon the WM Program to ensure packaged waste is configured such that the hazards remain Standard Industrial Hazards and do not impact the WMCs. The hazard evaluation also relies upon the WM program to ensure that radiation associated with packaged waste does not adversely impact the onsite worker due to WMC siting, and to ensure that hazardous waste packaging properly confines the materials.

The safety analysis assumes that the following WMC siting criteria are met:

- WMCs will be located no less than 850 meters from the nearest Site boundary (minimum distance used for evaluating the dose consequences to the public),
- WMCs will be located no less than the following distances from propane storage tanks: 126 feet from 1,000-gallon tanks, 100 feet from 500-gallon tanks, and 90 feet from 250-gallon tanks (larger overpressures from a boiling liquid expanding vapor explosion – BLEVE and close-in turbulent gas jet explosion are not analyzed),
- WMCs will be located no less than 15 feet from ~~propane storage tanks and propane and~~ natural gas distribution lines (minimizes the amount of vehicle and material handling equipment interaction that could cause a rupture of a distribution line ~~turbulent gas jet explosion scenarios not analyzed~~),
- WMCs will not be located in a flood plain (flooding scenarios are not evaluated),
- WMCs will be located no less than 30 feet from active railroad tracks (impacts from a train accident are not evaluated), and
- WMCs will not be located adjacent to a road that is used by fuel delivery vehicles with a capacity greater than 400 gallons (reduces frequency of major fire).

The safety analysis also assumes that packaged waste in WMCs is Site-approved (*i.e.* in compliance with applicable procedures and Quality Assurance specifications). This is an inherent assumption that preserves the damage ratios applied in the safety analysis.

4 HAZARDS AND ACCIDENT ANALYSIS

4.1 ANALYSIS METHODOLOGY

The hazards and accident analysis for Outdoor Waste Management is documented in Nuclear Safety Technical Report NSTR-001-02 (Ref. 8) and is summarized in this Outdoor Waste Management Safety Analysis Report. The hazards and accident analyses were performed to support the activities described in Section 2, *Outdoor Waste Management Activities*, for areas designated as Waste Management Cells (WMCs) and supports the final facility hazard categorization discussed in Section 4.8, *Final Hazard Categorization.*

Hazards Identification and Description

Table B-2 of the *Site Preliminary Hazards Analysis* (Ref. 9) was reviewed to assure that all potential hazards were considered during the development of NSTR-001-02 and this safety analysis document. NSTR-001-02 includes a Hazard Description Summary Table that identifies and documents potential hazards in terms of quantity, form, packaging, affected or affecting activities, and recognized preventive and/or mitigative features associated with the hazards. The Hazard Description Summary includes additional hazards unique to Outdoor Waste Management activities and is provided as Table 3 in Section 4.2, *Hazard Identification and Description.*

Based on information contained in the Site PHA and the Hazard Description Summary Table, determinations were made in NSTR-001-02 on whether further evaluation of specific hazards was necessary. In general, no further evaluation was performed on hazards that (1) were characterized as Standard Industrial Hazards and (2) have limited impact on postulated accident initiation frequency, accident mitigation, and accident consequences (in other words, hazards that do not contribute to accident source terms and are not accident precursors, initiators, or propagators). Standard industrial hazards are considered controlled by implementation of Site Safety Management Programs (SMPs), including DOE-prescribed occupational safety and health standards, and are not evaluated further unless they could initiate a release of hazardous materials or worsen the consequences of a hazardous material release.

Hazards Evaluation

For hazards that were determined to require further evaluation, NSTR-001-02 considered (1) scenario progression and related activities, (2) determination of accident types, and (3) a qualitative assessment of scenario frequency. Based on these considerations, a set of general accident scenarios was identified that is considered important to the development of WMC controls. This set of accident scenarios is summarized in Section 4.3, *Hazards Evaluation.* At this point in the hazards/accident analysis process, the descriptions and frequency assignments are general and have not been adjusted to reflect activity-specific conditions and operations associated with Outdoor Waste Management. There are ~~two~~ three general types of accident scenarios that could yield a radiological release: fires, ~~and~~ spills and explosions. Operational, natural phenomena, and external events may initiate these general types of scenarios. Explosions were dismissed from further analysis in NSTR-001-02.

~~Obstructed gas cloud explosions from large propane tanks or natural gas (methane) lines are dismissed from further analysis because the overpressures would not be enough to breach packaged waste (Ref. 10). A local-effect type of explosion called a turbulent jet flame explosion in which ignition of gases escaping a pipe, manifold, or container could lead to an explosion (Ref. 11). The minimum separation distance of 15 feet between a WMC and a propane or natural gas distribution line is imposed as a WMC siting criteria in Section 3, *Safety Management Programs*.~~

Nuclear criticality accident scenarios are not evaluated further as discussed in Section 4.3, *Hazards Evaluation.*

Selection of Accident Scenarios Requiring Further Evaluation

NSTR-001-02 further evaluated the general set of accident scenarios considering activity-specific conditions and operations. For each general type of accident scenario multiple specific accident scenarios were identified/postulated based on the operational activity being performed, storage and/or handling configuration, container type, waste type, *etc.*

NSTR-001-02 identified a representative set of accident scenarios based on a comparison of the initial respirable source term (IRST) for each of the specific unmitigated accident scenarios. The IRST was calculated by multiplying together the material-at-risk (MAR), the damage ratio (DR), and the airborne respirable release fraction (ARRF). Eighteen (18) accident scenarios (see Table 9) were identified as representative for Outdoor Waste Management activities and include fires, spills, natural phenomena hazard events, and external event scenarios. These scenarios, summarized in Section 4.4, *Selection of Representative Accident Scenarios*, are carried forward in this safety analysis report in order to determine the bounding accident scenarios to be analyzed. Selection of the bounding accident scenarios is discussed in Section 4.5, *Bounding Accident Scenarios*.

~~1.2~~4.2 HAZARD IDENTIFICATION AND DESCRIPTION

This section identifies the radioactive materials and other hazardous materials present during Outdoor Waste Management activities as well as identifying hazards and energy sources that may contribute to a radiological and/or toxicological release. Table 3 is the Hazard Description Summary Table from NSTR-001-02 and lists potential hazards in terms of quantity, form, packaging, affected or affecting activities, and recognized preventive and/or mitigative features associated with the hazards. Table 3 identifies those hazards that were further evaluated in NSTR-010-01 (~~NSTR-001-02~~Ref. 5) with a "Further Evaluated" notation in the Credited Protective Features column. Under the Remarks column, the first set of applicable SMPs address how the identified hazard/energy source is controlled and the second set addresses worker protection.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
1. ELECTRICAL ENERGY					
A. 13.8 kV Transformers [high voltage]	Std. transformers for converting Site power (13.8 kV) to facility power (480V).	Impact barriers (cement poles), fenced enclosures, equipment design.	SH, RA	HAZARD CONTROL • Combustible control [FIRE] • Configuration control [CM, NS, WM] WORKER PROTECTION • Impact barriers, insulated enclosure [CM, OS&IH] • Standard PPE, insulated clothing, insulated tools [OS&IH, TSM] • Equipment inspection, postings, LO/TO, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, TRAIN, TSM]	Used as source of Site electric power. Not an Accident Source Term/Precursor/Initiator/Propagator • Lower voltage electric power is considered in Safety Analysis as fire initiator (see THERMAL ENERGY/Electric Power System). • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to ~~separation from waste storage areas and~~ no identified mechanism for impact to waste containers. **Applicable SMPs:** CM; FIRE; NS; and WM. **Standard Industrial Hazard** • Worker electrocution or burn risk. **Applicable SMPs:** CM, COOP; DOC; IWCP; OS&IH; TRAIN; and TSM.
3. DIRECT RADIATION SOURCES:					
A. Sealed Sources	Site standard instrument calibration sources, radiological monitoring sources.	Site standard sealed source packaging, equipment design.	SH, GN, RA	HAZARD CONTROL • Package/container [RAD] • Configuration control [RAD] WORKER PROTECTION • Locked cabinet, shielding, enclosures, package/container, equipment design [RAD] • Protective clothing, dosimeters [RAD] • Monitoring, package inspection, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN]	Used for instrument calibration, including portable equipment, and radiological monitoring. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to low energies and no identified mechanism for impact to waste containers. **Applicable SMPs:** RAD. **Standard Industrial Hazard** • Worker radiation exposure risk. **Applicable SMPs:** COOP; DOC; IWCP; QA; RAD; and TRAIN

4.3 HAZARDS EVALUATION

Table 4 lists the general accident scenarios applicable to Outdoor Waste Management activities by scenario type. The table provides a description of the scenario progression and related activities as well as a qualitative assessment of scenario frequency. These general descriptions and frequency assignments do not reflect activity-specific conditions and operations associated with Outdoor Waste Management. For example in the description of the small fire scenario the waste type, container type, container storage configuration, MAR loading, associated activity, available mitigative features, *etc.* are not yet considered. Such activity-specific conditions were considered in NSTR-001-02 in order to identify a set of representative accident scenarios. Representative accident scenarios are discussed in Section 4.4, *Selection of Representative Accident Scenarios*.

Table 4 General Accident Scenarios

Scenario Type	Description
Storage and Handling (SH) Scenarios	
FIRE	SMALL. Transient combustible materials (*e.g.*, plywood, wooden pallets, flammable/combustible liquids, *etc.*) may be present in and around WMCs. If combustible materials are inadvertently stacked against or are in close proximity to waste containers and are ignited, several waste containers can be exposed to enough thermal energy to cause lid or lid seal failure and venting of radioactive materials. SMALL fire scenarios can be initiated by electric power or hot work and are judged to be *anticipated* events without prevention.
FIRE	MEDIUM. In the event that the combustible loading increases above that involved in a SMALL fire scenario, a MEDIUM fire can result that impacts additional waste containers beyond those involved in a SMALL fire scenario. Additional combustible loading may include leaking fuel from a fork-truck or tractor, or an excess amount of transient combustibles. MEDIUM fire scenarios can be initiated by electric power or hot work and are judged to be *anticipated* events without prevention.
FIRE	~~≥10 MW:~~ LARGE OR MAJOR (up to 400 gallons of liquid fuel). A larger fire can result that impacts additional waste containers beyond those involved in a MEDIUM fire scenario due to leaking fuel from a gasoline or diesel fuel-powered tractor or fuel delivery vehicle. These LARGE or MAJOR fire scenarios can be initiated by electric power, hot work, or range fires and are judged to be *anticipated* events without prevention.
FIRE	MAJOR (up to 8,500 gallons of liquid fuel). A larger fire can result that impacts additional waste containers beyond those involved in a LARGE fire scenario due to an accident involving a large-capacity fuel delivery vehicle. These MAJOR fire scenarios can be initiated by electric power, hot work, or range fires and are judged to be *unlikely* events without prevention.
FIRE	UNCONTAINERIZED ITEMS. A fire can result that impacts packaged waste items during loading, unloading, storage, and repackaging activities. This fire scenario can be initiated by electric power or hot work and is judged to be an *anticipated* event without prevention.
FIRE	TANKER TRUCK. A fire can result that impacts tanker trucks filled with wastewater. This fire scenario can be initiated by electric power, hot work, or range fires and is judged to be an *anticipated* event without prevention.

Table 4 General Accident Scenarios

Scenario Type	Description
Storage and Handling (SH) Scenarios (continued)	
SPILL & FIRE	CONTAINER: EXTERNAL EVENT. In the event of an aircraft crash, two release mechanisms are considered; spill and fire. Such spill and fire scenarios are a combination of two separate failure paths: (1) container failure/external/ mechanical/impact/natural phenomena hazard/ external event (NPH/EE) and (2) container failure/external/thermal/fire/NPH/EE. During an aircraft impact into a WMC, the kinetic energy dissipated into waste containers can breach several containers resulting in a spill of all or a portion of the container contents. Subsequent to impact, an ensuing pool fire can involve a number of waste containers. The pool fire can involve the waste containers spilled due to aircraft impact (unconfined material fire) as well as additional waste containers that may not have been breached due to aircraft impact (confined material fire). Aircraft crash induced spill and fire scenarios are judged to be *extremely unlikely* events without prevention.
Routine Activities (RA) Scenarios	
FIRE	CONTAINER: DIRECT FLAME IMPINGEMENT. Flammable gas torches are routinely used during maintenance and construction activities. In the event that a flammable gas device flame comes into direct contact with a stored waste container, a breach of the container is possible resulting in a radiological release. Direct flame impingement scenarios are judged to be *unlikely* events without prevention and are bounded by the SH fire scenarios. Therefore, direct flame impingement fires are not evaluated further.

A fire or spill scenario involving DOT Type B shipping containers [e.g., Transuranic Package Transport (TRUPACT) II] is not included in Table 4 because there are no identified release mechanisms for these containers due to the rigor of their construction.

An explosion scenario is not included in Table 4 because explosions (vapor cloud explosion, turbulent gas jet explosion and boiling liquid expanding vapor explosion [BLEVE]) were dismissed from further analysis in NSTR-001-02. The vapor cloud explosion scenario was shown to be bounded by the *unlikely* NPH Scenario 1: *Seismic-Induced Structural Failure* that involved the entire contents of a WMC. The turbulent gas jet explosions and BLEVE event were shown to be bounded by the *unlikely* (unprevented) Fire Scenario 1: *Major Waste Container Fire (8,500 Gal. Diesel)* that involved the entire contents of a WMC. The frequency of occurrence of the turbulent gas jet explosion (involving acetylene and propane cylinders) and vapor cloud explosion was determined to be *unlikely* without controls. The frequency of occurrence of the turbulent gas jet explosion (involving natural gas distribution lines) was determined to be *extremely unlikely* without controls. The frequency of occurrence of the BLEVE was determined to be *extremely unlikely* without controls. WMC siting controls are imposed to ensure that WMCs are sited with a minimum separation distance from propane storage tanks and natural gas distribution lines. Therefore, explosion scenarios are not evaluated further.

A criticality scenario is not included in Table 4 due to the limited radioactive material associated with LLW/LLMW, SCO, and LSA materials and the configuration of waste in Type B containers that are "incident-to-shipping." For these types of waste, criticalities are considered to

exceeded 1.0. Typical ERPG fractions (at a distance of 1,900 meters), for fire and spill scenarios, involving specific Item description Codes (IDCs) range from 10^{-13} to 10^{-4} per Nuclear Safety Calculation 96-SAE-006 (Ref. 17).

A *low* accident consequence has also been assigned to *unlikely* and *extremely unlikely* accident scenarios involving containerized mixed waste which result in the release of the contents of multiple containers. This *low* accident consequence has been qualitatively assigned based on multiple containers of multiple IDCs being breached and the low possibility of exceeding unity when summing the individual fractions for ERPG-2 at 1,900 meters or ERPG-3 at 100 meters. This low possibility is assumed based on the relatively small number of waste containers that will be present in WMCs, the number of waste containers involved in the bounding accident scenarios, and the very small ERPG fractions determined in Nuclear Safety Calculation 96-SAE-006 (Ref. 17) for analyzed waste IDCs typically stored at the Site. WMCs are located no closer than 850 meters to the nearest Site boundary. This distance is 2.2 times less than the 1,900 meters evaluated; however, the ERPG fractions are sufficiently small (orders of magnitude difference) that the conclusions do not change for WMCs evaluated at 850 meters.

Containerized wastes with Toxic Substances Control Act (TSCA) regulated Polychlorinated Biphenyls (PCBs) could also be present in the WMCs. Site PCB wastes include liquid PCB waste forms (oil with PCBs and fluorescent light ballasts) and solid PCB waste forms (drained PCB equipment, rags, debris, or soils). Liquid PCB waste forms include IDC 533 (PCB liquids with hazardous constituents), IDC 970 (PCB liquids without hazardous constituents), IDC 971 (PCB fluorescent light ballasts), and IDC 973 (PCB transformers/ capacitors). Solid PCB waste forms include IDC 972 (miscellaneous PCB debris). A *low* accident consequence has been assigned to accident scenarios involving containerized wastes with PCB liquids based on the small number of containers of these IDCs present at the Site. The ERPG-2 and ERPG-3 fractions for IDC 970 range from 10^{-8} to 10^{-5} for various accidents (e.g., fire or spill) and container types per Nuclear Safety Calculation 96-SAE-006. With ERPG fractions in this range, it would require a release from many containers to exceed the *low* accident consequence level. The storage of TSCA regulated waste meets all applicable requirements of the *TSCA Management Plan* (Ref. 18).

Table 5 Chemical Evaluation Summary

CHEMICAL OR CHEMICAL SOURCE	ACCIDENT CONSEQUENCE LEVEL*		
	MOI	Collocated Worker	Immediate Worker
Containerized Mixed Waste (release of a single container)	Moderate - Low	Moderate - Low	High - Low
Containerized Mixed Waste (release of multiple containers)	Moderate - Low	Moderate - Low	High - Low
TSCA Polychlorinated Biphenyl (PCB) Containerized Waste (potentially present)	Low	Low	Low

4.3.2 Radiological Hazards

A Surface Contaminated Object (SCO), as defined in 49 CFR 173 (Ref. 21), is a solid object which is not itself classed as radioactive material, but which has radioactive material distributed on any of its surfaces.

Low Specific Activity (LSA) material, as defined in 49 CFR 173, is a special classification given to any radioactive material which is dispersed throughout a substance to such an extent and in such a form that it poses little hazard even if released in an accident. The consequences associated with accidents involving this type of material are bounded by the safety analysis of LLW/LLMW materials.

Facility-specific criticality safety requirements are detailed for facilities that handle, process, store, stage, transfer, transport fissionable material (greater than 15 grams per container) in accordance with the Nuclear Criticality Safety Manual (Ref. 1514). Facilities or operational activities that contain more than a significant quantity of fissionable material, but only contain either waste material containing less than 100 nanocuries per gram of transuranic nuclides and no enriched uranium or packaged waste material containing less than or equal to 15 grams fissionable material in each 55-gallon or larger waste drum/package, are exempt from the facility-specific criticality safety requirements. As such, limitations are imposed on individual container inventory (see Section 5, *Technical Safety Requirements*) to ensure that Outdoor Waste Management activities remain exempt from criticality safety requirements.

The gram inventory threshold between a Hazard Category 3 Nuclear Facility and a Hazard Category 2 Nuclear Facility for depleted and enriched uranium is 710 metric tons and 110 metric tons, respectively. The total Site inventory of depleted and enriched uranium does not exceed Hazard Category 3 quantities. From a radiological dose consequence standpoint, it would take an amount of uranium that is several orders of magnitude greater than Aged WG Pu to produce the same dose consequence to a receptor. Therefore, depleted and enriched uranium are not evaluated further.

High americium wastes do not fall in the category of LLW (Ref. 7) and are not evaluated in this safety analysis. In-growth amounts of americium are accounted for in the accident analysis by evaluating the MAR as a Site Weapons Grade Plutonium (WG Pu) isotopic mix per the Safety Analysis and Risk Assessment Handbook (Ref. 6).~~The radiological dose consequences in this safety analysis are evaluated using Aged WG Pu to account for a 0.3% in-growth of americium. Americium separation operations created high-americium wastes before 1989 and LLW generated from these lines (e.g., decontamination activities) may show a higher americium content than that associated with ingrowth. A Waste and Environmental Management System (WEMS) query listing all LLW/LLMW containers yielded over 20,000 containers. Of these, 13,150 containers had Pu and/or americium content listed. A total of 22 of these 13,150 containers had a WG Pu equivalent content (based on an americium multiplier of 66) greater than 0.5 grams. In these cases, the americium was less than 50% of the mass (maximum reasonable percentage) and the Pu content was also less than 0.5 grams (higher WG Pu equivalent attributed to the americium loading and not the Pu content). This yielded a historical percentage of LLW/LLMW containers that may exceed the container limit due to americium content of 0.17%. While the percentage of these types of containers may go up as D&D activities remove high americium glovebox lines, the overall Site percentage will still be very low. In addition, the highest WG Pu equivalent content container had a loading of 2.9 grams which is below the 3 gram~~

~~bounding safety analysis value for drums (see Table 6, *Waste Container Type MAR Comparison*). Therefore, evaluating scenarios based on Aged WG Pu is judged to be conservative, and "high americium" LLW/LLMW waste forms are not evaluated further.~~

In the packaging of LLW/LLMW or SCO materials into waste containers, it is often the case that the analyzed Pu content of the container is not finalized until after the container is placed in a WMC. Based on the characterization of the waste prior to packaging, a conservative determination is made about the type of waste involved. If the waste is determined to be non-compliant with the per-container inventory limits in the Technical Safety Requirements, the container will not be placed in a WMC. If the waste is determined to be compliant, the container may be placed in the WMC prior to finalization of its Pu content based on the determination that the waste conforms to LLW/LLMW, SCO, or LSA requirements. The container may be placed in a WMC awaiting laboratory analysis of its contents, a final weighing of the container, or an assay of the container. Based on the results of the final characterization, the container may exceed the container limits associated with LLW/LLMW, SCO, or LSA materials.

Table 6 shows the amount of Aged WG Pu per container evaluated for accident scenarios involving metal drums, metal boxes, wood crates, and cargo containers. Wood crates are intended to cover any soft-sided waste containers such as super-sacks, soft boxes, *etc.* These values do not represent container limits in the "Evaluated Maximum Inventory Per Container" cases, but rather an upper threshold for the safety analysis.

Table 6 Waste Container Type MAR Comparison

Container Type	Evaluated Maximum Inventory Per Container (grams WG Pu)		AB Maximum Allowed Inventory Per Container (grams WG Pu)
	Accident Involving ≤ 3 Containers	Accident Involving > 3 Containers	
Drums	3	1	0.5
Low Capacity Containers (Net Weight Capacity ≤ 5,520 lbs.) [crates or boxes]	15*	6	3
High Capacity Containers (Net Weight Capacity > 5,520 lbs.) [cargo containers]	15*	15*	6+

* This limit set as a boundary based on Criticality Safety Program concerns.

\+ The Aged WG Pu inventory is controlled by being in compliance with DOT regulations that effectively limit the amount of Pu-239 to 6 grams per SCO shipment.

4.3.3 Evaluated Container Types

For the purpose of this safety analyses, the waste container/waste item types evaluated in the safety analysis are defined in Table 7, *Evaluated Container Types*.

Table 7 Evaluated Container Types

Container Type	Description
Drums	A metal drum. Includes but is not limited to 55-gallon waste drums and various sized overpack containers.
Boxes	A low-capacity metal container with a net weight capacity of no more than 5,520 lbs. Includes but is not limited to Standard Waste Boxes (SWBs), Sandia Metal Waste Boxes (SAN Boxes), High Efficiency Particulate Air (HEPA) Filter Coffins, HEPA Filter Standard Boxes.
Wood Crates	A low-capacity wooden container with a net weight capacity of no more than 5,520 lbs. Generally includes wooden containers of the same size or smaller than a Full Size Wooden Waste Box which is approximately 4 ft. × 4 ft.× 7 ft. Also intended to cover soft-sided containers like super-sacks.
Large Crates	A high-capacity wooden container with a net weight capacity in excess of 5,520 lbs. Generally includes wooden containers larger than Full-Size Wooden Waste Boxes.
Cargoes	A high-capacity metal container with a net weight capacity in excess of 5,520 lbs. Generally includes containers larger than SWBs and SAN Boxes including Cargo Containers and IP-1/2 Containers.
Large Packages	An un-containerized item (MAR values equivalent to high-capacity containers) that is usually too large to place into a container and that is packaged compliant with onsite transportation and/or Department of Transportation (DOT) requirements. Generally includes large metal items that are shrink-wrapped or have had contamination fixatives applied.
Tankers	Transport equipment for moving liquids with a capacity of about ~~5,000~~8,500 gallons.
Trailers	Transport equipment for moving containers and packages. Includes flatbeds and enclosed trailers.

4.4 SELECTION OF THE REPRESENTATIVE ACCIDENT SCENARIOS

The scenario selection process focuses on those aspects of the radiological dose consequence calculation model that vary between scenarios. Radiological dose consequence evaluations are performed using the following equation:

$$\text{Dose} = \text{MAR} * \text{DR} * \text{ARRF} * \text{LPF} * \chi/\text{Q} * \text{BR} * \text{DCF} / \text{PDC}$$

where
- MAR is the radioactive material-at-risk (in grams, varies with scenario);
- DR is the MAR damage ratio (varies with scenario);
- ARRF is the airborne respirable release fraction (varies with form of radioactive material and scenario);
- LPF is the facility leakpath factor (set to 1.0, outdoors);
- χ/Q is the atmospheric dispersion factor (in s/m^3, varies with receptor and scenario);
- BR is the receptor breathing rate (in m^3/s, set for heavy activity);

DCF is the radiological material dose conversion factor (in rem/gram, varies with material type); and

PDC is the plume duration correction factor (varies with scenario).

The PDC value is used for accident scenarios with a duration longer than 10 minutes (*e.g.*, some large fires). The PDC value is used to modify the atmospheric dispersion value to correct for plume meander during the scenario. The formula used for determining plume meander for longer duration releases is as follows:

$$PDC = (\text{plume duration in minutes} / \text{time base})^n$$

where the time base is 10 minutes; "n" has a value of 0.2 if the plume duration is less than or equal to 60 minutes; otherwise, "n" has a value of 0.25.

The radiological dose calculation parameters applicable for distinguishing between scenarios are MAR, DR, ARRF, χ/Q, and 1/PDC; the others remain constant within each accident scenario. MAR and DR vary with the scenarios based on package type and event size, ARRF varies with the scenario type (*e.g.*, fire, spill, *etc.*) and with the form of radioactive material (*e.g.*, confined or unconfined), χ/Q is affected by wind speed and amount of plume lofting in a fire event, and PDC is time dependent (the release duration for the scenarios are assumed to be 10 minutes unless otherwise stated).

The scenarios are compared against each of the applicable parameters of the dose calculation equation and a determination is made as to which scenarios are bounding based on their scores. The Atmospheric Dispersion Factors (χ/Q and PDC) are extracted from RADIDOSE (V1-4) and the RADIDOSE spreadsheet values yielding the presented results are listed. Table 8 presents this information. All of the parameters trend similarly for both the CW and MOI receptors, with the results for the CW being more prominent. Therefore, the CW receptor values for atmospheric dispersion factors are used to determine the relative ranking presented later in this section.

Table 8 Atmospheric Dispersion Factors

Atmospheric Dispersion Factors	χ/Q (CW @ 100 m)	Plume/Release Duration (min)	PDC	1/PDC
Non-Lofted	9.94E-3	10	1	1
Small Fire	1.51E-3	10	1	1
Medium Fire	6.98E-4	10	1	1
Large Fire	3.59E-4	10	1	1
Major Fire	9.89E-5	10	1	1
Small Fire: 60 min	1.06E-3	60	1.431	0.699
Medium Fire: 30 min	4.885.60E-4	30	1.246	0.803
Major Fire: 60 min	6.91E-5	60	1.431	0.699
Non-Lofted 8 hr (480 min)	3.78E-3	480	2.632	0.380
High Wind	1.26E-4	10	1	1

In those cases where the scenario consequences are composed of multiple components, the largest contributor is used and multiplied by the number of components to determine a scenario relative ranking value rather than evaluating each of the components and summing them together.

Individual waste container/item MAR values are generally assumed to vary from 0.5 grams for LLW/LLMW drums up to 6 grams for SCO/LSA items and large containers. However, packaged waste in a WMC may only have preliminary MAR estimates that may underestimate the amount of radioactive material present. This safety analysis evaluates overloaded LLW/LLMW, SCO waste, and LSA waste items at a higher amount than the standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items. For larger PACKAGED WASTE items, the MAR is evaluated up to an amount that is generally associated with a Criticality Safety Program limit of concern (*i.e.*, 15 grams). That is, PACKAGED WASTE items containing less than 15 grams of WG Pu are exempt from any Criticality Safety Program requirements. The intent of evaluating the PACKAGED WASTE items at a higher MAR value is to assess overloaded container configurations but not to permit the configuration as part of normal routine operations. The standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items remain in effect and waste items that exceed those limits are considered to be out-of-compliance with the inventory limits is Section 5, *Technical Safety Requirements*. However, Unreviewed Safety Question Determinations (USQDs) do not have to be performed for situations where the PACKAGED WASTE item MAR values are below the analyzed values. For scenarios that involve waste containers that are "incident-to-shipping," individual waste container MAR values are set to the controlled amount (*e.g.*, 0.5 grams per Drum, 3 grams per Box, *etc.*); otherwise the MAR values are analyzed at the higher values specified in Table 6, *Waste Container Type MAR Comparison*. Note that in some of the scenario evaluations specifically involving drums, individual drum MAR values are set to 1 gram.

For scenarios that involve waste containers that are "incident-to-shipping," individual waste container MAR values are set to the controlled amount (e.g., 0.5 grams per Drum, 3 grams per Box, *etc.*) because the waste is fully characterized; otherwise the waste item MAR values are analyzed at the higher values specified in Table 6, *Waste Container Type MAR Comparison*. For the large-scale accident scenarios (*i.e.*, ~~5,000~~8,500 gallon fuel pool fires, seismic, and aircraft crash), the maximum MAR for a WMC (900 g WG Pu) is postulated to be involved in the events.

Because criticalities are considered to be incredible, WMC MAR values are set at the nuclear facility Hazard Category 3 upper limit for plutonium for situations where criticalities are not possible (*i.e.*, 900 grams versus 450 grams for situations where criticalities are possible).

A Fire Hazards Analysis (FHA) evaluates and assesses the fire hazards associated with WMCs (Ref. 22).

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 3: Major Waste Container Fire (400 gal diesel)	Entire WMC composed of waste drums	Intent: This scenario postulates involvement of the largest MAR possible in a short duration fire, which results in major lofting. By postulating a fuel pool type of fire impacting drums, higher MAR involvement can occur due to the potential for drum lid loss and some unconfined material releases versus a confined material release found in wooden crate fires under similar conditions. The postulated scenario involves the currently permitted maximum amount of diesel fuel in a "unrestricted route, non-bulk fuel delivery" situation (400 gallons) in combination with a stacked arrangement of drums with the postulated fuel spill footprint (410 drums) involving an entire WMC inventory of 900 grams. The shortest duration fire lasts only 10 minutes. This fire must be highly intense to cause drum lid loss which yields major lofting. Note: It is assumed that this fire bounds any situation where more than one WMC is impacted by the fuel spill fire. The conservative assumption of involving the entire WMC inventory in the pool fire ensures that multiple WMC-impacting fires that involve only a portion of their inventory are bounded by this scenario. Components: There are three components to the fire: 1) MAR from ejected material associated with drum lid loss (25% of top tier); 2) MAR from non-ejected material associated with drum lid loss; and 3) MAR from drums with seal failure rather than lid loss (75% of top tier and 100% of lower tiers). Summary: Part 1: MAR = 103 grams, DR = 0.33, ARRF = 1.0E-2, χ/Q = major fire lofting. [largest contributor] Part 2: MAR = 103 grams, DR = 0.67, ARRF = 5.0E-4, χ/Q = major fire lofting. Part 3: MAR = 797 grams, DR = 0.50, ARRF = 5.0E-4, χ/Q = major fire lofting.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 4: Major Waste Container Fire (~~5,000~~8,500 gal diesel)	Entire WMC composed of waste drums	Intent: This scenario postulates involvement of the largest MAR possible in a long duration intense fire, which results in major lofting. By postulating a fuel pool type of fire impacting drums, high initial MAR involvement can occur due to the potential for drum lid loss and some short duration unconfined material releases. The lighter material that is ejected is assumed to have an ARF of 1E-2. The heavier material that is not ejected is assumed to have an ARF of 5E-2). By exposing the containers to a very long duration and intense fire, releases in excess of the standard 5E-4 confined material ~~release fraction~~ARF are expected. While this release may not be as large as the bounding~~an~~ unconfined material ~~release~~ARF (*i.e.*, 5E-2), the release is conservatively evaluated using ~~the unconfined material~~this ~~release fraction~~ARF in lieu of determining the actual ~~release fraction~~ARF. ~~The remaining unconfined~~ material release from the remaining drums is assumed to occur over the period of an hour as the normally confined material pyrolyzes beyond the point that is normally analyzed. Therefore, the ARF for these drums is assumed to be 5E-2.~~ The postulated fire involves a bulk fuel delivery vehicle in combination with a non-stacked arrangement of drums involving an entire WMC inventory of 900 grams. The initial unconfined material release lasts 10 minutes and the remaining unconfined material release lasts 60 minutes. This fire must be highly intense to cause drum lid loss and subsequent extensive pyrolyzation which yields major lofting. Note: It is assumed that this fire bounds any situation where more than one WMC is impacted by the fuel spill fire. As the spilled fuel pool size gets larger such that multiple WMCs are involved, the pool depth decreases making the duration of the fire go down, reducing the subsequent "extensive pyrolyzation". Therefore, the conservative assumption associated with analyzing the fire as an unconfined release of an entire WMC ensures that multiple WMC-impacting fires are bounded by this scenario. Components: There are three components to the fire: 1) MAR from ejected material associated with drum lid loss (25% of drums since spill footprint can cover entire WMC); 2) MAR from non-ejected material associated with drum lid loss; and 3) MAR from drums with seal failure rather than lid loss (75% of drums). Summary: Part 1: MAR = 225 grams, DR = 0.33, ARRF = ~~5~~1.0E-2, χ/Q = major fire lofting. Part 2: MAR = 225 grams, DR = 0.67, ARRF = 5.0E-2, χ/Q = major fire lofting, PDC based on duration of 60 minutes. Part 3: MAR = 675 grams, DR = 1.00, ARRF = 5.0E-2, χ/Q = major fire lofting, PDC based on duration of 60 minutes [largest contributor].

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 5: Un-containerized Item Fire	Single "open" waste item	Intent: This scenario postulates involvement of an initially unconfined MAR in a fire with limited lofting. "Un-containerized" waste is postulated to occur during the packaging of cargo containers, for example. This waste is normally confined in plastic bags since the safety analysis does not authorize the packaging/repackaging of externally contaminated items, but no credit is taken for the plastic bags to serve to confine the material in the fire. The MAR value is evaluated at 15 grams. The limited lofting can occur by assuming a small fire (1 MW) lofting effect. Summary: MAR = 15 grams, DR = 1.0, ARRF = 5.0E-2, χ/Q = small fire lofting.
Fire 6: Tanker Truck Fire	Single tanker truck with aqueous liquid waste	Intent: This scenario postulates involvement of an aqueous radioactive solution in a fire with limited lofting. The release mechanism is associated with boiling rather than burning. A fire sufficient to boil the contents of a tanker truck is postulated. The boiling liquid pressurizes the tanker causing relief valves to actuate and vent the tanker leading to the release. The venting is assumed to occur in a manner that is not directly impacted by the fire; that is, the vented material is only lofted like a small fire (1 MW) even though the fire leading to the event may be a major fire. The MAR value is evaluated at 15 grams. Summary: MAR = 15 grams, DR = 1.0, ARRF = 2.0E-3, χ/Q = small fire lofting.
Fire 7: Truck Trailer Fire	Incident-to-shipping trailer with waste ~~boxes~~crates	Intent: This scenario postulates involvement of radioactive material that is incident-to-shipping. A fire sufficient to impact the entire contents of a truck trailer loaded with waste crates~~boxes~~ is postulated. Because the waste is "incident-to-shipping," it is characterized and is limited to 3 grams per ~~box~~ crate and the trailer load is set at 36 ~~boxes~~crates. ~~A~~ *medium* fire (5 MW) is not large enough to impact the entire trailer contents but a *large* fire (10 MW) is assumed to be large enough to impact the load. Summary: MAR = 108 grams, DR = ~~0.2~~1.0, ARRF = 5.0E-4, χ/Q = large fire lofting.

Table 10 Bounding Scenario Determination

	Fire: Waste Container Fire (Small Fire Intensity)	Fire: Waste Container Fire (Medium Fire Intensity)	Fire: Major Waste Container Fire (400 gal diesel)*	Fire: Major Waste Container Fire (8,500 gal diesel)*	Fire: Un-containerized Item Fire	Fire: Tanker Truck Fire	Fire: Truck Trailer Fire	Fire: Non-Aqueous Liquid Waste Fire	Spill: Waste Container Drop/Fall	Spill: Waste Container Puncture by Forklift Tine	Spill: Compressed Gas Cylinder Missile	Spill: Crane Load Drop	Spill: Wastewater Tanker Spill*	NPH: Seismic-Induced Structural Failure	NPH: Lightning Breach	NPH: High Winds and Tornadoes	EE: Aircraft Crash*	EE: Ground Vehicle Impact
MAR	900	900	103	675	15	15	108	900	15	15	30	90	15	900	15	900	900	90
DR	1	1	0.33	1	1	1	1	1	1	0.1	1	1	1	1	0.1	0.1	0.25	0.1
ARRF	5.0E-04	5.0E-04	1.0E-02	1.0E-02	5.0E-02	2.0E-03	5.0E-04	7.0E-02	1.0E-04	1.0E-03	1.0E-04	1.0E-04	3.2E-04	1.0E-04	1.4E-02	1.0E-04	5.0E-02	1.0E-04
X/Q	1.5E-03	5.6E-04	9.9E-05	9.9E-05	1.5E-03	1.5E-03	3.6E-04	9.9E-05	9.9E-03	9.9E-03	9.9E-03	9.9E-03	9.9E-03	9.9E-03	9.9E-03	1.3E-04	9.9E-05	9.9E-03
1/PDC	0.699	0.803	1	0.699	1	1	1	1	1	1	1	1	0.38	1	1	1	1	1
# of Comp	1	1	3	3	1	1	1	1	1	1	1	1	3	1	1	1	3	1
Score	4.7E-04	2.0E-04	1.0E-04	1.4E-03	1.1E-03	4.5E-05	1.9E-05	6.2E-03	1.5E-05	1.5E-05	3.0E-05	8.9E-05	5.4E-05	8.9E-04	2.1E-04	1.1E-06	3.3E-03	8.9E-06
Frequency	A	A	A	U	A	A	A	A	A	A	U	A	A	U	A	A	EU	A
Bounding				X				X				X		X	X		X	X

* Highest contributing components used for scenarios with multiple components and then multiplied by number of components
MAR does not include mitigative controls
Frequency does not include preventive controls

4.5 BOUNDING ACCIDENT SCENARIOS

An assessment of the 18 representative accident scenarios summarized in Section 4.4, *Selection of the Representative Accident Scenarios*, compared the radiological dose calculation parameters for the various scenarios. A determination of the bounding accident scenarios is made based on their scores. Of these scenarios derived from NSTR-001-02, seven are carried forward for further analysis. These are the scenarios with the highest "scores" for each scenario category, and more than one is chosen (as applicable) when there is more than one representative bounding scenario in different frequency bins.

The bounding accident scenarios from Table 10, *Bounding Scenario Determination* are identified below. The scenarios are summarized and further evaluated if needed. Preventive or mitigative controls are applied when appropriate in accordance with the Authorization Basis development guidance from DOE, RFFO (Ref 23).

1. Unlikely Fire – Major Waste Container Fire (~~5,000~~8,500 Gallons of Diesel)
2. Anticipated Fire – Non-Aqueous Liquid Waste Fire
3. Anticipated Spill – Crane Load Drop (bounds unlikely spill)
4. Unlikely NPH – Seismic-Induced Structural Failure
5. Anticipated NPH - Lightning Breach
6. Extremely Unlikely EE - Aircraft Crash
7. Anticipated EE - Ground Vehicle Impact

~~1.1.1~~4.5.1 Major Waste Container Fire (~~5,000~~8,500 Gal. Diesel)

Accident Scenario

It is postulated that a diesel fuel delivery truck spills its ~~5,000~~8,500-gallon payload of diesel fuel and involves waste containers located at a WMC. It is assumed that a collision breaches the tanker and ignites the resulting fuel pool. At a depth of 1 cm, the pool fire area is 3217~~1892.5~~ m^2 (~~20,371~~34,620 ft^2). Portions of the pool would likely be deeper due to the large volume of fuel spilled and irregularities of outdoor surfaces with natural and man-made barriers. This pool fire would be large enough to potentially involve the entire inventory of a WMC.

Accident Frequency

The frequency of this fire is *unlikely* without preventive controls due to the low speeds along Site roadways adjacent to WMCs and the low number of deliveries at the Site (Ref. 4). The scenario becomes *extremely unlikely* when crediting ***Route Control*** for large fuel delivery tanker trucks (*i.e.*, > 400 gallon fuel capacity) to ~~restrict~~ prohibit access to WMCs or roadways ~~immediately~~ adjacent to WMCs.

Material-At-Risk

By postulating a fuel pool type of fire impacting drums, high initial MAR involvement can occur due to the potential for drum lid loss and some short duration unconfined material releases. The lighter material that is ejected is assumed to have an ARF of 1E-2. The heavier material that is not ejected is assumed to have an ARF of 5E-2.

By exposing the containers to a very long duration and intense fire, releases in excess of the standard 5E-4 confined material ~~release fraction~~ARF are expected. While this release may not be as large as ~~an~~ the bounding unconfined material ~~release~~ARF (*i.e.*, 5E-2), the release is conservatively evaluated using this ~~release fraction~~ARF in lieu of determining the actual ~~release fraction~~ARF. The ~~remaining unconfined~~ material release from the remaining drums is assumed to occur over the period of an hour as the normally confined material pyrolyzes beyond the point that is normally analyzed. Therefore, the ARF for these drums is assumed to be 5E-2.

The postulated fire involves a bulk fuel delivery vehicle in combination with a non-stacked arrangement of drums involving an entire WMC inventory of 900 grams. The initial unconfined material release lasts 10 minutes and the remaining unconfined material release lasts 60 minutes. This fire must be highly intense to cause drum lid loss and subsequent extensive pyrolyzation which yields major lofting.

It is assumed that this fire bounds any situation where more than one WMC is impacted by the fuel spill fire. As the spilled fuel pool size gets larger such that multiple WMCs are involved, the pool depth decreases making the duration of the fire go down, reducing the subsequent "extensive pyrolyzation." Therefore, the conservative assumption associated with analyzing the fire as an unconfined release of an entire WMC ensures that multiple WMC-impacting fires are bounded by this scenario.

There are three components to the *major* fire: 1) MAR from ejected material associated with drum lid loss (25% of drums since spill footprint can cover entire WMC); 2) MAR from non-ejected material associated with drum lid loss; and 3) MAR from drums with seal failure rather than lid loss (75% of drums). A DCF based on ICRP-68 Moderate Solubility Class is used.

Part 1: MAR = 225 grams, DR = 0.33, ARRF = ~~5~~1.0E-2, duration of 10 minutes.
Part 2: MAR = 225 grams, DR = 0.67, ARRF = 5.0E-2, duration of 60 minutes.
Part 3: MAR = 675 grams, DR = 1.0, ARRF = 5.0E-2, duration of 60 minutes.

Accident Consequences

Dose Consequences (rem)		Risk Class Without Prevention (*unlikely*)		Risk Class With Prevention (*extremely unlikely*)	
CW	**MOI**	**CW**	**MOI**	**CW**	**MOI**
1~~1~~2.0E+1 (moderate)	9.7E-1~~1~~1 (moderate)	II	II	III	III

Controls

Route Control – Fuel delivery tanker trucks or other fossil fuel powered vehicles having a total fuel capacity of greater than 400 gallons shall not be driven on a WMC or on a roadway adjacent to a WMC. This control reduces the scenario frequency from *unlikely* to *extremely unlikely*. ***Route Control*** is a Site SAR control (STC 4).

A ***WMC Inventory Control*** imposes a 900 g maximum inventory per WMC to set the maximum MAR for the scenario. No other specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.2 Fire – Non-Aqueous Liquid Waste

Accident Scenario

It is postulated that a fire involves non-aqueous liquid waste (e.g., solvents, oils, *etc.*) stored either in drums or tanker trucks at a WMC. By postulating a WMC composed entirely of non-aqueous liquid waste containers which will tend to propagate the fire from container to container in a rapid fashion, it is possible to involve the entire WMC inventory, which is 900 grams. For the unmitigated case, the bounding scenario is a fire involving the entire inventory of a WMC comprised of all non-aqueous liquid waste. For the mitigated case, a ***WMC inventory control*** is applied to limit the amount of non-aqueous liquid waste available to be involved in the scenario.

Accident Frequency

The frequency of this fire is *anticipated* without preventive controls.

Material-At-Risk

For the unmitigated case, the bounding scenario involves 900 grams Aged WG Pu.

Accident Consequences - Unmitigated

Dose Consequences (rem)		Risk Class Without Prevention (*unlikely*)	
CW	MOI	CW	MOI
3.1 (low)	1.1E-1 (low)	III	III

Damage to packaged waste resulting in a radiological material release could also occur due to a less severe seismic event. The damage and subsequent consequences of such an event would be low and the Risk Class determination would be the same.

Controls

A ***WMC Inventory Control*** imposes a 900 g maximum inventory per WMC to set the maximum MAR for the scenario. No other specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.5 NPH: Lightning Breach

Accident Scenario

It is postulated that a large waste container in a WMC that is separated from nearby facilities is directly struck by lightning. WMC containers that are located in close proximity to buildings or other high profile equipment are expected to be significantly less vulnerable to **direct** lighting strikes due to the tendency for the lightning to strike high profile objects rather than low profile objects. The effect of the lightning strike is most likely to be nothing more than a metal container surface burn with no impact to the contents of the package or serve as another initiator of a fire if the WMC contains wooden crates. The potential worst-case effect of the strike is unpredictable. The outer surface of a metal container is most likely to direct the lightning away from any internal contents of the container. However, if the waste container has within it pieces of metal equipment, these items could serve to create a pathway for the lightning to travel through the container, particularly given the significant energy involved in a lightning strike. It is postulated that the lightning strike could travel through the container and could rapidly heat any residual liquids inside of the container leading to a rapid pressurization of the container (*i.e.*, steam explosion), causing a release similar to an "internal explosion." The current Site methodology associated with container internal hydrogen explosions is used to bound any effects of this type caused by a lightning strike.

Table 11 Radiological Dose Consequence and Risk Class Determination

Scenario	MAR	DR	ARF	RF	LPF	χ/Q (CW)	χ/Q (MOI)	BR	DCF	Consequences				Freq*	Risk Class	
										CW Dose (rem)	MOI Dose (rem)	CW	MOI		CW	MOI
1. Major Waste Container Fire, 8,500 Gallons of Diesel Fuel, Lid Loss, Material Ejection	2.25E+02	0.33	1.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	2.6E-01	2.4E-02	-	-	-	-	-
1. Major Waste Container Fire, 8,500 Gallons of Diesel Fuel, Lid Loss, No Material Ejection	2.25E+02	0.66	5.00E-02	1.0	1.0	6.91E-05	6.59E-05	3.60E-04	9.70E+06	1.8E+00	1.7E-01	-	-	-	-	-
1. Major Waste Container Fire, 8,500 Gallons of Diesel Fuel, Seal Failure	6.75E+02	1.00	5.00E-02	1.0	1.0	6.91E-05	6.59E-06	3.60E-04	9.70E+06	8.1E+00	7.8E-01	-	-	-	-	-
1. Total :Major Waste Container Fire	9.00E+02	-	-	-	-	-	-	-	-	1.0E+01	9.7E-01	Moderate	Moderate	EU	III	III
2. Non-Aqueous Liquid Waste Fire, Unmitigated:** 900 Grams	9.00E+02	1.00	7.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	2.2E+01	2.1E+00	Moderate	Moderate	A	I	I
2. Non-Aqueous Liquid Waste Fire, Mitigated:** 150 Grams	1.50E+02	1.00	7.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	3.6E+00	3.5E-01	Low	Low	A	III	III
3. Spill: Crane Load Drop	9.00E+01	1.00	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	3.1E-01	1.1E-02	Low	Low	A	III	III
4. NPH, Seismic-Induced Structural Failure	9.00E+02	1.00	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	3.1E+00	1.1E-01	Low	Low	A	III	III
5. NPH: Lightning Breach	1.50E+01	0.10	2.00E-02	0.7	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	7.3E-01	2.6E-02	Low	Low	A	III	III
6. External Event: Aircraft Crash (Spill)	9.00E+02	0.25	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	7.8E-01	2.7E-02	-	-	-	-	-
6. External Event: Aircraft Crash (Fire, Unconfined Material)	9.00E+02	0.25	5.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	3.9E+00	3.7E-01	-	-	-	-	-
6. External Event: Aircraft Crash (Fire, Confined Material)	9.00E+02	0.75	5.00E-04	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	1.2E-01	1.1E-02					
6. Total: External Event/Aircraft Crash	-	-	-	-	-	-	-	-	-	4.8E+00	4.1E-01	Low	Low	EU	IV	IV
7. External Event: Ground Vehicle Impact	9.00E+02	0.10	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	3.1E-01	1.1E-02	Low	Low	A	III	III

* The accident frequency for the Major Waste Container Fire is shown with prevention, the frequency without prevention is *unlikely*.

4.7 WORKER SAFETY EVALUATION

Administration of the derived or institutionalized controls affords an adequate level of protection to the Immediate Worker commensurate with the hazards. It was expected that any further detailed analyses of the identified hazards would not result in any additional controls other than those already contained in the SMP infrastructure to protect the Immediate Worker. Table B-2 of the Site PHA, NSTR-007-01 (Ref. 98) was reviewed to assure that all potentially available preventive and mitigative controls were considered during the development of this Authorization Basis document. In the event the detailed analysis presented in NSTR-007-01 indicates that the hazards and consequences are significant, those SMP controls needed to protect the Immediate Worker will be identified for TSR coverage as Safety SSCs or Administrative Controls. Therefore, it is assumed that if no additional controls are identified, the SMP infrastructure is adequate for protecting the Immediate Worker, and no additional risk determinations will be presented unless the scenario involves serious injury or prompt death.

4.8 FINAL HAZARD CATEGORIZATION

The radiological inventory, which constitutes the material at risk (MAR) for any individual WMC, will not exceed 900 grams WG Pu as controlled administratively. Based on the maximum possible radioactive material inventory and results of the accident analysis in Section 4.5, the WMCs within the scope of this safety analysis are categorized as Hazard Category 3 Nuclear Facilities per DOE-STD-1027-92 (Ref. 2).

4.9 DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

Based on the hazards and low risk associated with WMCs, no safety structures, systems, and components (SSCs) are relied upon to protect the collocated worker and/or the public. Therefore, no Limiting Conditions for Operation (LCOs) have been written for the Outdoor Waste Management activities. The Technical Safety Requirements derived for the Outdoor Waste Management activities consist only of Administrative Controls (ACs).

TERM	DEFINITION
DISCOVERY/ DISCOVERED	For SRs, the point in time when WASTE MANAGEMENT CELL management is notified of, or reviews, information showing that a SR was not met. For AC compliance, the point in time when WASTE MANAGEMENT CELL management makes the determination that an AC is not being met or that an unplanned CONDITION has been entered and REQUIRED ACTIONS must be implemented. Note: The definitions listed above apply to TSR compliance and should not be confused with AB inadequacy discovery issues.
LIMITING CONDITION FOR OPERATION (LCO)	The lowest functional capability or performance level of SAFETY SSCs and their support systems required for safe operations of the facility.
PACKAGED WASTE	PACKAGED WASTE refers to either an un-containerized waste item [e.g., Surface Contaminated Object (SCO) or Low Specific Activity (LSA)] or a containerized waste item (*e.g.*, in a drum, box, *etc.*).
REQUIRED ACTIONS	The mandatory response when an AC CONDITION is entered.
SURVEILLANCE	Process or activity documenting that ACs and AOLs are met.
SURVEILLANCE REQUIREMENTS (SRs)	Testing, calibration, or inspection requirements to ensure that the AC required safety function is maintained and/or that operations are within the specified criteria of the ACs.
SUSPEND OPERATIONS	A formal suspension of those activities capable of initiating an analyzed operational accident (e.g., movement or handling of PACKAGED WASTE, hot work, flammable gas use) except for those directly involved in: 1. Placing and maintaining the WASTE MANAGEMENT CELL in a safe configuration; 2. Restoring the safety function associated with the suspension; or 3. Remediating AC NONCOMPLIANCES; This means that activities such as tours, inspections, and maintenance not requiring PACKAGED WASTE or material handling equipment movement, hot work, or flammable gas use may be authorized.
TECHNICAL SAFETY REQUIREMENTS (TSRs)	Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe conduct of WASTE MANAGEMENT CELL activities and to reduce the potential risk to the public and site workers from uncontrolled releases of radioactive materials. A TSR consists of ACs, use and application instructions, and the BASES thereof.

TERM	DEFINITION
VIOLATION	An ~~AC~~ TSR VIOLATION occurs when the WASTE MANAGEMENT CELL Management: a. fails to take REQUIRED ACTIONS within the specified COMPLETION TIME after failing to meet an AC or AC SR; b. fails to perform an AC SR within the specified frequency including the "grace period" (violates SR 5.5.2); c. fails to SUSPEND OPERATIONS when REQUIRED ACTIONS cannot be met or are not provided (violates AC 5.5.3); or d. determines that continued recurrence of an AC NONCOMPLIANCE represents a safety-significant trend (violates AC 5.5.4). A VIOLATION is considered historical if the CONDITION was corrected prior to DISCOVERY.
WASTE MANAGEMENT CELL	Areas used for outdoor management of nuclear material as operated in accordance with the criteria in AOL 1.1 through AOL 1.3.

CONTROLS/RESTRICTIONS:

AOL 1	NUCLEAR MATERIAL LOADING
AOL 1.1	The total quantity of nuclear material present at a WASTE MANAGEMENT CELL **SHALL NOT** exceed 900 grams WG Pu~~, and must be verified by either inventory tracking or an alternate approved means~~.
AOL 1.2	The total quantity of nuclear material present in non-aqueous liquid waste at a WASTE MANAGEMENT CELL **SHALL NOT** exceed 150 grams WG Pu~~, and must be verified by either inventory tracking or an alternate approved means~~.
AOL 1.3	The quantity of nuclear material in a PACKAGED WASTE item received, staged, or stored at a WASTE MANAGEMENT CELL **SHALL NOT** exceed the following gram limits (WG Pu): • ≥ 55-gallon ~~LLW/LLMW~~ Drums: 0.5 grams • < 55-gallon and > 10-gallon ~~LLW/LLMW~~ Drums: 0.4 grams • ≤ 10-gallon ~~LLW/LLMW~~ Drums: 0.2 grams • ~~LLW/LLMW~~ Container (Box or Crate) ≤ 5,520 lbs (net weight capacity): 3 grams • ~~LLW/LLMW~~ Container (Box, Crate, or Cargo Container) > 5,520 lbs (net weight capacity): 6 -grams • Un-containerized SCO or LSA Item: 6 grams • Tanker Truck Containing ~~l~~Liquid ~~LLW/LLMW~~: 6 grams

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. WASTE MANAGEMENT CELL not compliant with AOL 1.1 or AOL 1.2.	A.1 ~~Bring the non-compliant WASTE MANAGEMENT CELL into compliance with the AOLs.~~Suspend acceptance of PACKAGED WASTE receipts at the WASTE MANAGEMENT CELL.	~~96~~ 1 hours.
	AND	
	A.2 Bring the non-compliant WASTE MANAGEMENT CELL into compliance with the AOLs.	3 weeks.
B. PACKAGED WASTE item not compliant with AOL 1.3.	~~C~~B.1 ~~If discovered during receipt, remove the non-compliant PACKAGED WASTE from the WASTE MANAGEMENT CELL.~~Suspend all PACKAGED WASTE movements within 10 feet of the non-compliant PACKAGED WASTE item.	~~8 hours.~~ 1 hour.
	AND	
	B.2.1 Bring the non-compliant PACKAGED WASTE item into compliance.	~~96 hours.~~ 3 weeks.
	OR	
	B.2.2 Remove the non-compliant PACKAGED WASTE item from the WASTE MANAGEMENT CELL	3 weeks.
	~~**OR**~~	
	~~C.2 If discovered during storage, remove the non-compliant PACKAGED WASTE from the WASTE MANAGEMENT CELL.~~	

SURVEILLANCE REQUIREMENTS:

	SURVEILLANCE REQUIREMENT	FREQUENCY
SR 5.6.1	Verify that the WASTE MANAGEMENT CELL does not exceed the criteria in AOL 1.1.	Monthly.
SR 5.6.2	Verify that the WASTE MANAGEMENT CELL does not exceed the criteria in AOL 1.2.	Monthly.
SR 5.6.3	Verify that the PACKAGED WASTE item (with a final radiological characterization) that is to be transferred to the WASTE MANAGEMENT CELL does not exceed the criteria of AOL 1.3.	Prior to transfer of the PACKAGED WASTE item.
SR 5.6.4	Verify that a PACKAGED WASTE item (with preliminary radiological characterization) that is to be transferred to the WASTE MANAGEMENT CELL does not exceed the criteria of AOL 1.3.	Prior to transfer of the PACKAGED WASTE item (based on the preliminary characterization) **AND** Within one week of final radiological characterization of the PACKAGED WASTE item if the final characterization exceeds the preliminary characterization.
SR 5.6.5	Verify that a PACKAGED WASTE item being generated within the WASTE MANAGEMENT CELL does not exceed the criteria of AOL 1.3.	Within one week of final radiological characterization of the PACKAGED WASTE item.

5B TECHNICAL SAFETY REQUIREMENTS BASES

5B.6 INVENTORY CONTROL AND MATERIAL MANAGEMENT BASES

5B.6.1 Requirement for Inventory Control and Material Management

Inventory Control and Material Management provides control for the location, storage configuration, and handling of nuclear material within a WASTE MANAGEMENT CELL based on the quantity, type, and form. This element protects the assumptions of the accident analysis that limit the amount of MAR available for potential release in the event of an accident.

5B.6.2 Specific Controls or Restrictions

Specific controls and restrictions are placed on radiological material inventory (PACKAGED WASTE items and WASTE MANAGEMENT CELLS) to prevent the introduction of materials into any of the WASTE MANAGEMENT CELLS that would invalidate the safety analysis basis.

AOL 1.1 restricts the total amount of WG Pu to 900 grams total per WASTE MANAGEMENT CELL. This control preserves the hazard classification of Nuclear Facility Hazard Category 3 for WASTE MANAGEMENT CELLS. This control also sets the initial MAR for the scenarios that involve an entire WASTE MANAGEMENT CELL (*i.e.*, major fires, seismic, aircraft crash).

AOL 1.2 restricts the total amount of WG Pu in non-aqueous liquid wastes to 150 grams per WASTE MANAGEMENT CELL. For the purpose of this safety analysis, non-aqueous liquids are considered to be liquids that burn rather than boil when exposed to fires. This control sets the maximum amount of MAR that can be involved in a non-aqueous liquid waste fire because a fire involving non-aqueous liquid waste is expected to propagate from container to container due to the high heat release associated with this waste form.

The total radiological inventory of a WASTE MANAGEMENT CELL can be tracked by maintaining records of the cumulative contents of PACKAGED WASTE at a WASTE MANAGEMENT CELL. The radiological inventory can be based on final radiological characterization, conservative default values for PACKAGED WASTE items, or a combination of both. The final radiological characterization for a PACKAGED WASTE item is a gram loading value that is not anticipated to be changed prior to offsite shipment. A conservative default value may be based on statistical data, process knowledge, maximum loading value based on the net weight capacity of PACKAGED WASTE items, or other assessment method indicating that the waste is LLW/LLMW, SCO, or LSA. Default values will be evaluated via the SES/USQD process to ensure that their use for inventory tracking will not compromise the hazard categorization of a WASTE MANAGEMENT CELL.

~~For the purpose of this control set, this is referred to as inventory tracking. However, compliance with AOL 1.1 and AOL 1.2 could also be ensured by combinations of physical configuration constraints and procedural controls. For example, a WASTE MANAGEMENT CELL that is used~~

~~for the staging of trailers to be taken offsite could ensure compliance with AOL 1.1 by limiting the number of trailers that can be staged if the maximum content of the trailers can be determined. If each trailer can contain a maximum of 50 grams of WG Pu and space within the WASTE MANAGEMENT CELL is limited to a maximum of 15 trailers, only 750 grams of WG Pu can exist in the WASTE MANAGEMENT CELL and the conduct of SURVEILLANCES SR 5.6.1 through SR 5.6.4 would not have to be performed.~~

~~If a WASTE MANAGEMENT CELL will utilize a means other than inventory tracking to ensure compliance with AOL 1.1 and/or AOL 1.2, that alternate approach must be validated during an independent readiness determination of the WASTE MANAGEMENT CELL operations prior to eliminating the requirement to perform SURVEILLANCES SR 5.6.1 through SR 5.6.4 and/or SURVEILLANCES SR 5.6.5 through SR 5.6.7.~~

~~T~~The standard assumed MAR loadings for LLW/LLMW containers (see Appendix I) are carried forward as requirements in AOL 1.3. Individual PACKAGED WASTE MAR values are generally assumed to vary from 0.5 grams for LLW/LLMW drums up to 6 grams for SCO items and bulk LLW/LLMW in large containers.

When available, gram values from WEMS may be used to comply with AOL 1.3. However, PACKAGED WASTE items in a WASTE MANAGEMENT CELL may have only a preliminary designation of LLW, LLMW, SCO, or LSA without an associated WG Pu gram value. In the packaging of LLW/LLMW or SCO materials into waste containers, it is often the case that the analyzed Pu content of the container is not finalized until after the container is placed in a WASTE MANAGEMENT CELL. Based on the characterization of the waste prior to packaging, a conservative determination is made about the type of waste involved (*i.e.*, LLW/LLMW, SCO, LSA, or TRU). If the waste is determined to be non-compliant with the per-container inventory limits in the TSRs (*i.e.*, it is TRU waste), the container will not be placed in a WASTE MANAGEMENT CELL. If the waste is LLW/LLMW, SCO or LSA based on an initial characterization, the container may be placed in the WASTE MANAGEMENT CELL prior to finalization of its Pu content. The container may be placed in a WASTE MANAGEMENT CELL awaiting laboratory analysis of its contents, a final weighing of the container, or an assay of the container if needed. If the results of the final characterization shows that a PACKAGED WASTE item exceeds the container limits associated with LLW/LLMW, SCO, or LSA materials, the REQUIRED ACTIONS would apply.

A preliminary characterization may be based on process knowledge, scan data, radiological surveys, statistical data, default values, bounding values, or other assessment methods indicating that the waste is LLW/LLMW, SCO, or LSA. ~~However, PACKAGED WASTE items in a WASTE MANAGEMENT CELL may only have~~A situation could arise where the preliminary MAR estimate~~s that~~ may underestimate the actual amount of radioactive material present in a PACKAGED WASTE item. This safety analysis evaluates overloaded LLW/LLMW, SCO waste, and LSA waste items at a higher amount than the standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items. For larger PACKAGED WASTE items, the MAR is evaluated up to an amount that is generally associated with a Criticality Safety Program limit of concern (*i.e.*, 15 grams). That is, PACKAGED WASTE items containing less than 15 grams of WG Pu are exempt from any Criticality Safety Program requirements. The intent of evaluating the PACKAGED WASTE items

at a higher MAR value is to assess overloaded container configurations but not to permit the configuration as part of normal routine operations. The standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items remain in effect and waste items that exceed those limits are considered to be out-of-compliance with AOL 1.3. However, Unreviewed Safety Question Determinations (USQDs) do not have to be performed for situations where the PACKAGED WASTE item MAR values are below the analyzed values. For scenarios that involve waste containers that are "incident-to-shipping," individual waste container MAR values are set to the controlled amount (e.g., 0.5 grams per Drum, 3 grams per Box, *etc.*); otherwise the MAR values are analyzed at the higher values specified in Table 6, *Waste Container Type MAR Comparison*. The exception for AOL 1.3 allows higher MAR values for metal containers that are used as secondary confinement (*i.e.*, drums in a cargo container). High americium wastes do not fall in the category of LLW and are not evaluated in this safety analysis.

~~In the packaging of LLW/LLMW or SCO materials into waste containers, it is often the case that the analyzed Pu content of the container is not finalized until after the container is placed in a WASTE MANAGEMENT CELL. Based on the characterization of the waste prior to packaging, a conservative determination is made about the type of waste involved (*i.e.*, LLW/LLMW, SCO, LSA, or TRU). If the waste is determined to be non-compliant with the per-container inventory limits in the TSRs (*i.e.*, it is TRU waste), the container will not be placed in a WASTE MANAGEMENT CELL. If the waste is LLW/LLMW, SCO or LSA based on an initial characterization, the container may be placed in the WASTE MANAGEMENT CELL prior to finalization of its Pu content. The container may be placed in a WASTE MANAGEMENT CELL awaiting laboratory analysis of its contents, a final weighing of the container, or an assay of the container if needed. Based on the results of the final characterization, the container may exceed the container limits associated with LLW/LLMW, SCO, or LSA materials and the REQUIRED ACTIONS would apply.~~

The safety analysis specifies limits on PACKAGED WASTE item fissionable material content for uranium and plutonium wastes as defined by the Site Criticality Safety Program. Compliance verification occurs prior to PACKAGED WASTE transfer into a WASTE MANAGEMENT CELL using whatever radiological inventory assessment was developed for the PACKAGED WASTE. This assessment could represent a final characterization of the PACKAGED WASTE item radiological material inventory, or it could represent a preliminary characterization. ~~This preliminary characterization may be based on process knowledge, scan data, radiological surveys, default values, bounding values, or other assessment methods indicating that the waste is LLW/LLMW, SCO, or LSA.~~

~~In the event that the radiological inventory assessment of a PACKAGED WASTE item was preliminary or the PACKAGED WASTE item was generated in the WASTE MANAGEMENT CELL, a final radiological inventory characterization would be pending. A gram loading value that is not anticipated to be changed prior to offsite shipment is considered to be a final radiological characterization. Once the final radiological characterization is received by the manager of a WASTE MANAGEMENT CELL, a final radiological inventory compliance verification of the PACKAGED WASTE item must be conducted within one week only if the final characterization gram content exceeds the preliminary characterization gram content of the PACKAGED WASTE~~

~~item. Typically, any noncompliance would be readily discernable and would be dealt with in a timely fashion. Note that the one-week requirement for determination of compliance places no restrictions on how long a waste container can be in a WASTE MANAGEMENT CELL without a final radiological characterization.~~

~~By requiring a final radiological inventory compliance verification only in those cases where the final characterization exceeds its preliminary characterization, it is possible to operate a WASTE MANAGEMENT CELL using default/bounding values for the PACKAGED WASTE items as preliminary characterization gram content values and never need to update the inventory tracking except in those infrequent cases where a PACKAGED WASTE item exceeds the bounding value. This potentially reduces the effort needed to maintain documentation of a compliant configuration.~~

The REQUIRED ACTIONS and COMPLETION TIMES assure that WASTE MANAGEMENT CELLS maintain compliance with the specific controls and restrictions. The COMPLETION TIMES generally allow sufficient time ~~for coordinating a PACKAGED WASTE transfer~~to re-establish compliance with the AOLs. ~~and are judged to be reasonable based on the risk.~~

If a WASTE MANAGEMENT CELL exceeds the total inventory limits specified in AOLs 1.1 and 1.2, acceptance of PACKAGED WASTE item receipts in the WASTE MANAGEMENT CELL must be suspended within 1 hour. Based upon the simplicity of the PACKAGED WASTE movement activities in WASTE MANAGEMENT CELLS, one hour is judged to be adequate to notify all workers in the WASTE MANAGEMENT CELL to suspend receipt activities.

If a WASTE MANAGEMENT CELL exceeds the total inventory limits specified in AOLs 1.1 and 1.2, the WASTE MANAGEMENT CELL shall be brought into compliance with the limits in AOLs 1.1 and 1.2. Compliance may be established by removing PACKAGED WASTE item(s), re-assay to obtain a more accurate count, expert review of an existing assay, or correction of the non-compliance. Bringing the WASTE MANAGEMENT CELL within 3 weeks is required. Three weeks is considered adequate time for WASTE MANAGEMENT CELL management to identify, communicate with, and coordinate a transfer to an appropriate on-site facility.

If a PACKAGED WASTE item in a WASTE MANAGEMENT CELL contains more than the specified nuclear material limits in AOL 1.3, all PACKAGED WASTE item movement within 10 feet of the non-compliant PACKAGED WASTE item must be suspended within 1 hour. Based upon the simplicity of the PACKAGED WASTE movement activities in WASTE MANAGEMENT CELLS, one hour is judged to be adequate to notify all workers in the vicinity to suspend movement activities and to safely secure the handling equipment. It is judged that the 10-foot separation provides an adequate buffer to protect the non-compliant PACKAGED WASTE item from impacts with material handling equipment.

If a PACKAGED WASTE item in a WASTE MANAGEMENT CELL contains more than the specified nuclear material limit in AOL 1.3, it is to be removed from the WMC or brought into compliance. Compliance may be established by re-assay to obtain a more accurate count, expert review of an existing assay, or correction of the non-compliance. Bringing the WASTE MANAGEMENT CELL within 3 weeks is required. Three weeks is considered adequate time for

WASTE MANAGEMENT CELL management to identify, communicate with, and coordinate a transfer to an appropriate on-site facility.

An increase in a specific PACKAGED WASTE item MAR does not have any impact on contiguous PACKAGED WASTE items, other than for issues dealing with criticality. Therefore, for all accidents not involving a criticality, high MAR PACKAGED WASTE items do not require segregation. The Criticality Safety Program is credited for handling any criticality issues related to high MAR PACKAGED WASTE items and their movement.

The likelihood of an occurrence of an accident involving identified high MAR PACKAGED WASTE item(s) is small during the maximum three-week interval for removal or achieving compliance.

SRs 5.6.1 through SR 5.6.~~7~~5 are intended to assure that the WASTE MANAGEMENT CELLS are operated within the bounds of the safety analysis. Verification prior to transfer that the PACKAGED WASTE items are LLW, LLMW, SCO or LSA provides a reasonable assurance that the hazards associated with WASTE MANAGEMENT CELLS remain low. ~~Immediate verification of compliance is not required due to the limited hazards associated with the waste types evaluated in this safety analysis. Therefore, container inventory compliance verification within a week of final radiological characterization is appropriate and maintains an acceptable level of risk.~~

SR 5.6.~~1~~3 through SR 5.6.~~3~~5 cover three situations~~cover three cases~~: (1) receipt of a PACKAGED WASTE item with final characterization, (2) receipt of a PACKAGED WASTE item with preliminary characterization, and (3) generation of a PACKAGED WASTE item in a WASTE MANAGEMENT CELL, respectively. ~~In the first case~~For SR 5.6.3 the surveillance~~s~~ is~~are~~ only performed prior to transfer. ~~In the second case~~For SR 5.6.4, ~~the~~ a "prior to transfer" surveillance always~~s~~ must be performed, but~~,~~ the "after final characterization" surveillance only needs to be performed if the final characterization gram value is greater than the preliminary characterization gram value. ~~In the third case~~For SR 5.6.5, only the "after final characterization" surveillance~~s are~~ is required because waste generated from an existing PACKAGED WASTE item on a WMC will not exceed the AOL 1.3 thresholds (TRU waste cannot be generated from LLW). ~~Similarly, SR 5.6.5 and SR 5.6.6 apply to the first two cases (non-aqueous liquid PACKAGED WASTE items are not anticipated to be generated in a WASTE MANAGEMENT CELL so the third case is not applicable for SURVEILLANCES against AOL 1.2). The same three cases are applicable to SR 5.6.8 through SR 5.6.10.~~

~~Performance of SR 5.6.4 and SR 5.6.7 on a quarterly basis provides assurance that the day-to-day inventory tracking activities accurately reflect WASTE MANAGEMENT CELL compliance with AOL 1.1 and AOL 1.2 for WASTE MANAGEMENT CELLS that utilize inventory tracking as the means to demonstrate compliance.~~In the event that the radiological inventory assessment of a PACKAGED WASTE item was preliminary or the PACKAGED WASTE item was generated in the WASTE MANAGEMENT CELL, a final radiological inventory characterization would be pending. A gram loading value that is not anticipated to be changed prior to offsite shipment is considered to be a final radiological characterization. Once the final radiological characterization is received by the manager of a WASTE MANAGEMENT CELL, a final radiological inventory

compliance verification of the PACKAGED WASTE item must be conducted within one week only if: (1) the final characterization gram content exceeds the preliminary characterization gram content of the PACKAGED WASTE item, or (2) the preliminary characterization was qualitatively determined to be LLW, LLMW, SCO, or LSA materials based on process knowledge. Typically, any noncompliance would be readily discernable and would be dealt with in a timely fashion. Note that the one-week requirement for determination of compliance places no restrictions on how long a waste container can be in a WASTE MANAGEMENT CELL without a final radiological characterization.

By requiring a final radiological inventory compliance verification only in those cases where the final characterization exceeds its preliminary characterization, it is possible to operate a WASTE MANAGEMENT CELL using default/bounding values for compliance with AOLs 1.1 and 1.2. This means that the inventory tracking to support SR 5.6.1 and 5.6.2 would not need to be updated except in those infrequent cases where a PACKAGED WASTE item exceeds the preliminary or default/bounding value. This potentially reduces the effort needed to maintain documentation of a compliant configuration. If the final radiological characterization gram values obtained for specific PACKAGED WASTE items are less than the default or bounding values, the one-week time limit would not apply and the values may be applied to those PACKAGED WASTE items. This would only need to be done for instances when a less conservative estimate of total WMC inventory is desired.

WASTE MANAGEMENT CELL inventory verification on a monthly basis, and PACKAGED WASTE item inventory compliance verification within a week of final radiological characterization are appropriate to maintain an acceptable level of risk due to the limited hazards associated with the waste types evaluated in this safety analysis.

5B.7 SAFETY MANAGEMENT PROGRAMS BASES

5B.7.1 Requirements for Safety Management Programs

This AC makes a commitment to Safety Management Programs (SMPs). The commitment to each program encompasses a large number of details that are more appropriately covered in program documents. These SMPs provide specific safety functions assumed in the safety analysis that are either specifically credited or recognized to be important for providing defense-in-depth. The cumulative effect of these details are recognized as being important to WASTE MANAGEMENT CELL safety, which is the rationale for a top-level commitment becoming part of the safety basis. In addition to worker safety, the cumulative affect of the programmatic details is important to Site safety and is an integral part of the Site safety envelope.

The SMP AOL 5.7.1a is established to ensure that there is a commitment to SMPs at the Site. The commitment to each program encompasses a large number of details that are more appropriately covered in program documents. The cumulative affect of these details is recognized as being important to Site safety, which is the rationale for a top-level programmatic commitment becoming

6 REFERENCES

1 *Nuclear Safety Management*, 10 CFR 830, Code of Federal Regulations, U.S. Department of Energy, Washington, D.C., revised January 10, 2001.

2 *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports,* DOE-STD-1027-92, U.S. Department of Energy, Washington, D.C., December, 1995.

3 *Nuclear Safety Management*, 10 CFR 830, Code of Federal Regulations, U.S. Department of Energy, Washington, DC, revised January 10, 2001.

4 *Rocky Flats Environmental Technology Site Safety Analysis Report*, Revision 2, Rocky Flats Environmental Technology Site, November 2000.

5 *Safety Analysis for Waste Management Activities*, NSTR-010-01, Nuclear Safety Technical Report, Kaiser-Hill, L.L.C., Rocky Flats Environmental Technology Site, ~~as revised~~ DC-01, December 2001.

6 *Safety Analysis and Risk Assessment Handbook*, RFP-5098, Rev. 2, Kaiser-Hill Company, L.L.C., Golden, CO, December 6, 1999.

7 *Americium Measurements at Rocky Flats*, Nuclear Safety Technical Report NSTR-011-97, Revision 0, Rocky Flats Environmental Technology Site, June 24, 1997.

8 *Safety Analysis for Outdoor Waste Management*, NSTR-001-02, Revision 0, Rocky Flats Environmental Technology Site, ~~January~~ April 2002.

9 *Site Preliminary Hazards Analysis*, NSTR-007-01, Revision 0, Rocky Flats Environmental Technology Site, August 2001.

10 ~~Nuclear Safety Calculation, CALC-RFP-02.0114-VLP, *Obstructed Gas Cloud Explosions in Outdoor Waste Management Cells*~~, USQD-RFP-02.0352-ARS, Revision ~~0~~1, Rocky Flats Environmental Technology Site, Golden, CO, ~~October~~ April 17~~31~~, 2002~~1~~.

11 USQD-RFP-01.0001-KBB, *Evaluation of DCS-991-00.1888-KBB, Hydrogen Gas Turbulent Jet Flame Explosion and DCS-RFP-01.0012-VLP, Sitewide Evaluation of Possible Turbulent Jet Explosions*," Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, June 14, 2001.

12 Code of Federal Regulations, 40 CFR 355, *EPA Regulations for Emergency Planning and Notification Under CERCLA*, Office of the Federal Register, August 1993.

13 Code of Federal Regulations, 40 CFR 68, Risk Management Programs for Chemical Accidental Release Prevention, Office of the Federal Register, 1995.

14 Code of Federal Regulations , 29 CFR 1910, *Occupational Safety and Health Standards*, Office of the Federal Register, May 1993.

15 *Nuclear Criticality Safety Manual*, MAN-088-NSCM, Revision 3, Rocky Flats Environmental Technology Site, Golden, CO, November 30, 2000.

16 *Criticality Incredibility Analysis for Waste Storage Facilities*, Revision 2, Rocky Flats Environmental Technology Site, Golden, CO, November 29, 2001.

17 *Generalized IDC/WFC Chemical & Radiological Characterization and Consequences Calculations*, 96-SAE-006, Nuclear Engineering, Rocky Flats Environmental Technology Site, August 14, 1996.

18 *TSCA Management Plan*, 1-10000-EWQA, Revision 0, EG&G Rocky Flats Plant, February 1993.

19 *Final Safety Analysis Report for the 750/904 Pads Waste Storage Facility Rocky Flats Site,* Revision 9, Kaiser-Hill Company, L.L.C., Golden, CO, March 2001.

20 *Final Safety Analysis Report and Technical Safety Requirements for the Building 664 Waste Storage and Shipping Facility Rocky Flats Plant,* Revision 6, Kaiser-Hill Company, L.L.C., Golden, CO, January, 1998.

21 Code of Federal Regulations, 49 CFR 173, *General Requirements for Shipments and Packaging*, Office of the Federal Register~~, as revised~~.

22 *Fire Hazards Analysis for RCRA Units and Waste Management Cells*, FHA-RCRAWMC-001, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, February 11, 2002.

23 *Authorization Basis Development*, Ltr. From B. A. Mazurowski to R. G. Card, AME:NRD:MP:00-02784, Department of Energy, Rocky Flats Field Office, June 12, 2000.

24 *Analysis of Aircraft Crash Accidents at the Rocky Flats Environmental Technology Site*, Emergency Planning Technical Report, 97-EPTR-004, H. Jordan, Rocky Flats Environmental Technology Site, Golden, CO, June 1997.

25 *Radiological Dose Template*, Version 1.4.1, V.L. Peterson, Rocky Flats Environmental Technology Site, Golden, CO, ~~as revised~~April 2001.

7.7.4.5 Bases for Site Transportation Control for Fuels

Specific Controls or Restrictions Bases for STC 4

No specific controls are identified for the transfer of fuels.

Programmatic Controls Bases for STC 4 (The numbers in parentheses correspond to the controls in Section 7.5.4.5, Table 7-7.)

(1) Maintaining combustibles and ignition sources 20 feet from fuel storage tanks reduces potential for fire in the area of the storage tank that may affect facilities in the area.

(2) Designated routes limit potential interactions with the fissile material transfer vehicle. Minimizing the presence of propane, by maintaining a safe distance between a transfer vehicle and a propane delivery vehicle, eliminates the potential for explosion external to the transfer vehicle. The designated route for fuel delivery is per the most current procedure.

Designated routes also limit the potential interactions with fuel delivery vehicles (>400 gallon capacity) and Waste Management Cells (WMCs). Prohibiting the large fuel delivery vehicles (>400 gallon capacity) on WMCs and roads adjacent to WMCs reduces the major fire accident frequency from unlikely to extremely unlikely. This is accomplished by using alternate routes (not adjacent to WMCs.) The designated routes for fuel delivery is per the most current procedure.

(3) Security and emergency response events are imbedded in the base frequency number for accidents per mile and probability of a fuel spill and fire that results in a release of radiological material CALC-RFP-98.1545-KKK, Revision 3 (RFETS, 2000c). It is assumed the delivery vehicles follow the posted speed limits.

(4) Adequate staffing of the Fire Department is credited to reduce the frequency for fuel delivery vehicle accidents that could impact a vulnerable area of a nuclear facility to the incredible range. For the 2,000-gallon diesel tanker and the propane tanker Fire Department staffing provides defense-in-depth to reduce the frequency to well below the 1.0E-06/year to 1.0E-7/year. Deliveries from off-site vendors to the garage will not affect a nuclear facility if the route does not include Cactus Avenue south of Buildings 440 and 664, and Seventh Street east of Building 664.

7.7.4.6 Bases for Site Transportation Controls for Material Transfer Vehicle Loading/Unloading Operations and Transfers Between Facilities Using Powered Industrial Trucks

For the purpose of compliance with STC 5, the boundary between the material transfer vehicle loading and unloading activity and the facility is the point when the package enters or leaves the control of the nuclear facility. In the case of material transfer vehicle unloading operations under STC 5, it is the point where the PIT or crane sets a package down and is no longer in contact with the package. For material transfer vehicle loading operations under STC 5, it is the point at which the PIT or crane comes into contact with the package for the purpose of moving the package to the material transfer vehicle. The STC 5 controls do not supersede existing dock requirements or controls in facility-specific Authorization Bases. In cases where STC 5 and a facility Authorization Bases are in conflict, the facility Authorization Bases shall take precedence.

RECEIVED

Revised 06/02

2002 JUN 17 A 11:00

CORRES. CONTROL INCOMING LTR NO. 02369 RF02

CORRESPONDENCE CONTROL

DUE DATE JUN 13 2002

ACTION

States Government

Memorandum

Department of Energy
Rocky Flats Field Office

SP:NRD:DEF:02-00922

DIST.	LTR	ENC
BOGNAR, E.	X	X
BRAILSFORD, M.D.	X	X
CIUCCI, J. A.	X	X
COLALANCIA, M.	X	X
DEGENHART, K.	X	X
DEICHLER, C.	X	X
FERREIRA, D.		
FERRI, M. S.		
GEIS, J. A.	X	X
GERMAIN, A. L.		
GIACOMINI, J.		
HANSON, J. L.	X	X
MARTINEZ, L. A.	X	X
MCFARREN, P.	X	X
MCLAUGHLIN, J.	X	X
MILLER, G. M.	X	X
MILLER, J. C.	X	X
PARKER, A.M.	X	X
POWERS, K.	X	X
SCOTT, G.K.		
SHELTON, D.C.		
SNYDER, D.	X	X
SPEARS, M.S.	X	X
TRICE, K.D.		
TUOR, N.R.	X	X
VOORHEIS, G. M.		
SWANSON, B	X	X
OWEN, D	X	X
ITO, F.	X	X
ARMSTRONG, A	X	X
COR. CONTROL	X	X
ADMIN. RECORD		
PATS/130		

Reviewed for Addressee Corres. Control RFP

6/17/02 By

Ref. Ltr. # 02RF01350

DOE ORDER # 5480-23

Approval of Building 460 Final Documented Safety Analysis

Marvin D. Brailsford, Vice President
Project Manager for Material Stewardship and Off-site Shipment
Kaiser-Hill Company, L.L.C.

Reference: Letter, Brailsford to Mazurowski, 02-RF-01350, dtd 06/11/02, subject: Transmittal of the Final Documented Safety Analysis (FDSA) for Building 460 - MDB-050-02

The reference transmitted the final version of the Building 460 Final Documented Safety Analysis (FDSA) to the Department of Energy (DOE) Rocky Flats Field Office (RFFO) for approval. The attached Safety Evaluation Report (SER) for the Building 460 FDSA, Revision 0, provides the basis for approval, directed changes, implementation issues, and annual update issues. The SER shall be issued with the controlled copy distribution of the Building 460 FDSA. The Building 460 FDSA is approved with the DOE direction contained in the SER.

This is also an opportunity to recognize the individuals contributing to the development of the Building 460 FDSA. They have produced a document that thoroughly analyzes the planned operations for the facility, with an accident analysis that reflects facility operations. A significant effort was also made to ensure that previous DOE technical direction was incorporated into the FDSA and that DOE review comments were addressed in a timely manner. The task of implementation still remains and is to be accomplished within 90 days of DOE approval of the level of Readiness Determination to be performed. Should you have any questions, please contact me at extension 2025 or my point of contact on this matter, Mr. David Faulkner, at extension 2011.

Barbara A. Mazurowski

Barbara A. Mazurowski
Manager

Attachment

cc w/Att:
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F. Shepperd, EM-33, HQ
D. Owen, DNFSB, RFFO
J. Schneider, AMP, RFFO
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